RAILROAD GAZETTE

FRIDAY, JANUARY 22, 1904.

CONTENTS



## Contributions

### Long Life of Creosoted Ties.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The extraordinary length of life of creosoted timber, when the creosoting has been well done, is again illustrated by the result of an inspection made in July of last year on a piece of double track of the main line of the French Eastern Railway, between Paris and Strassbourg. This track, consisting of two sections, was completed in 1876. The ties were laid in the years 1873-1876, and each tie had a dating nail placed in the middle of the upper surface. These nails were carefully counted in July of this year, with the results shown in the following tables. Each track had 15,000 ties, with 10 ties per rail (the rails were 8 meters long and 30 kilos in weight).

*Track I.—French Eastern Railway. Count of Dating Nails, July, 1903.*

| Location of track. | 1873. | 1874. | 1875. | 1876. | Total. | Per cent. of original ties in track. |
|---|---|---|---|---|---|---|
| Kilometers 96-102 | .. | 706 | 3,583 | 5 | 4,294 | .. |
| Kilometers 107-113 | .. | ... | ... | 2,590 | 2,590 | .. |
| Total | | | | | 6,884 | 46 |

*Track II.—French Eastern Railway. Count of Dating Nails, July, 1903.*

| Location of track. | 1873. | 1874. | 1875. | 1876. | Total. | Per cent. of original ties in track. |
|---|---|---|---|---|---|---|
| Kilometers 96-102 | 25 | 156 | 1,575 | 187 | 1,943 | .. |
| Kilometers 107-113 | .. | ... | ... | 2,620 | 2,620 | .. |
| Total | | | | | 4,563 | 31 |

In other words, after 30 years' service 46 per cent. of the original ties are still in service in one case, and 31 per cent. in another case. An examination of a second stretch of track, laid in 1891, by the French Eastern Railway, showed the following. This track extends from Paris to Mulhouse between kilometer posts 17,500 and 26,000, and was laid with creosoted beech ties in 1891. Twelve thousand ties were laid in all; 17 ties to a rail length of 12 meters. An inspection was made in July, 1903, the dating nails were carefully counted and it was found that there were present in the track, of the ties laid in 1891, 11,976 ties. In other words, in the years 1891 to 1903, that is 12 years, only 24 ties had been removed.

HERMANN VON SCHRENK,
*In charge Mississippi Valley Laboratory, St. Louis.*

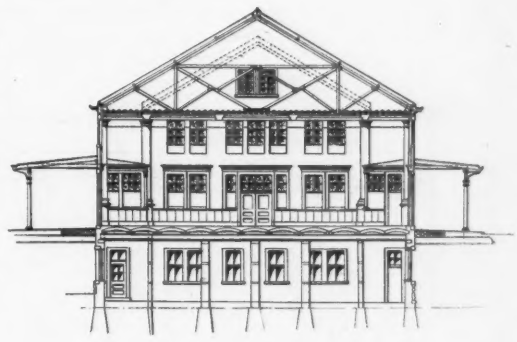
### The New Bridgeport Station.

In connection with the change of line and track elevation at Bridgeport, Conn., the New York, New Haven & Hartford will erect a large new station to replace the old and insufficient structure now in use. The train level will be at the second story of the new station and connections with the street level will be made by means of a ramp, stairways and a passenger elevator. The accompanying illustrations show the Water street elevation of the station, the floor plan at track level and the cross section at the point marked A-B on the floor plan.

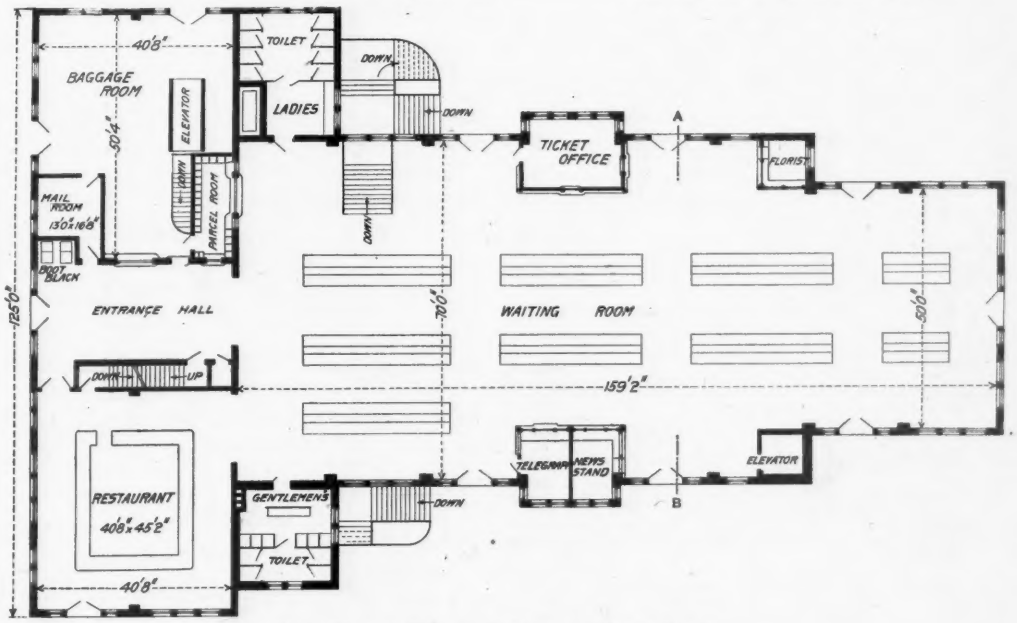
The station will be 203 ft. long over all, with the platform for the Berkshire and Naugatuck Division tracks also on the high level. Elevation of these tracks is now in progress. The basement of the station will be of light-colored granite and above this the walls will be of buff and Tiffany brick, with a roof of red slate. The structure will have a substantial and trim appearance. From the north end (the end toward New Haven) the waiting-room is entered by a hallway 20 ft. wide and 40 ft. long. On the west of the hallway is a restaurant 41 ft. x 45 ft. and on the east side a baggage-room 50 ft. x 41 ft. There are also package and parcel rooms, a place for a boot-black stand, etc. The passageway from the eastbound to the westbound tracks will be down an easy flight of stairs, below the track and up on the other side. The entrance to the station at the south end opens directly into the waiting-room, which is at track level. The door is reached by an inclined approach 220 ft. long, 12 ft. wide at the Fairfield avenue end, and 20 ft. wide at the station platform, with a rise of about 8 per cent. The main waiting-room, 160 ft. x 70 ft., has a clear story overhead to make it light and airy. It will be finished with a marble wainscot extending 4½ ft. above the floor, plastered walls upon that and a painted metal ceiling. The floor is to be terazzo, with bands of marble, and the woodwork will be quartered oak. The track platforms can be reached without entering the waiting-room either by passing directly through the subway, under the tracks, or by the staircase leading down to Stratford avenue on the east side of the station.

Seven tracks will enter the station. The track nearest the station on the east side is for the Berkshire Division. On the west side there will be a spare track next the station with crossovers to reach the four tracks of the main line and a platform between the extra tracks and the main tracks. On the extreme east will be the Naugatuck Division track, as at present.

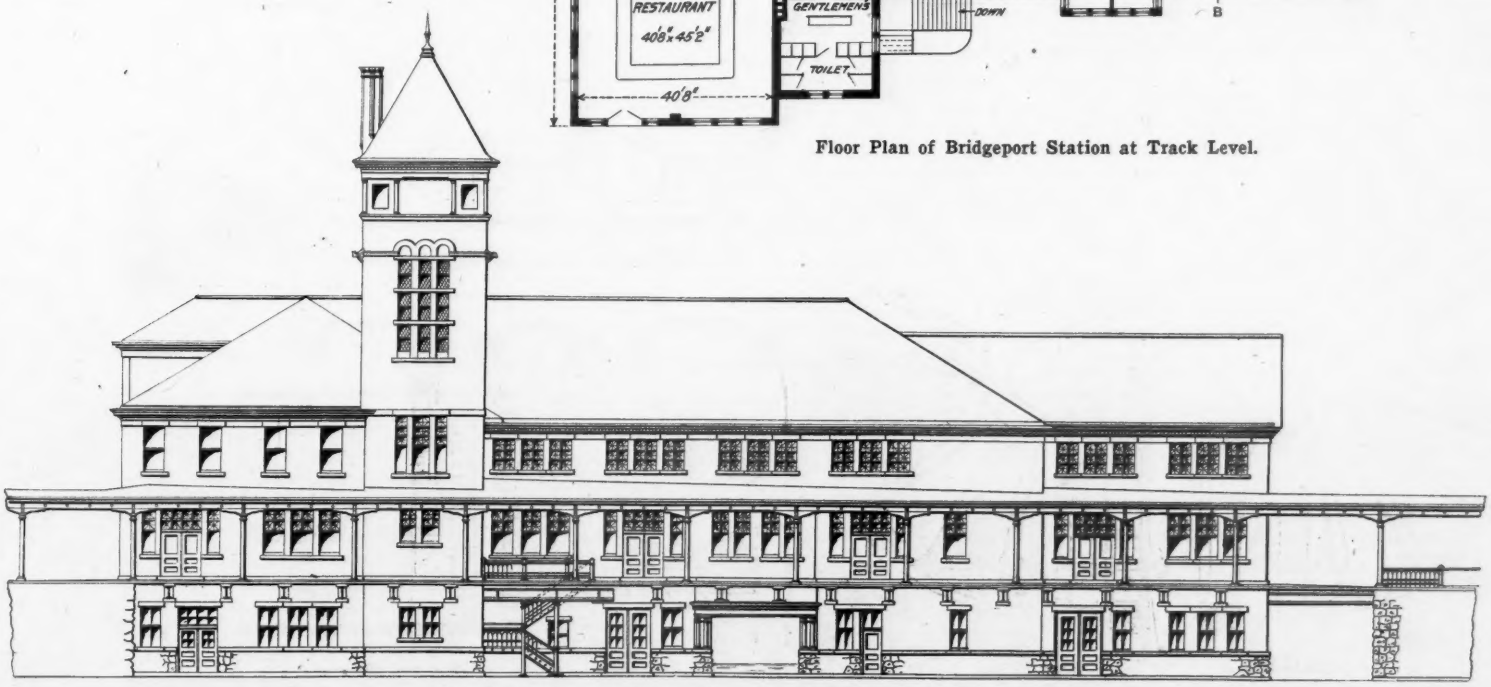
The station is so arranged that the second story at the north end is adapted for the use of offices and will ultimately be divided off for that purpose unless it should be found necessary to use a portion of that floor for restaurant purposes. The building is situated only a short distance from the harbor and will have a pile foundation. It is not expected that it will be in use before the summer of 1905. The station was designed by Warren H. Briggs, Supervising Architect, of Bridgeport, Conn., to whom we are indebted for the illustrations and information contained in this article.



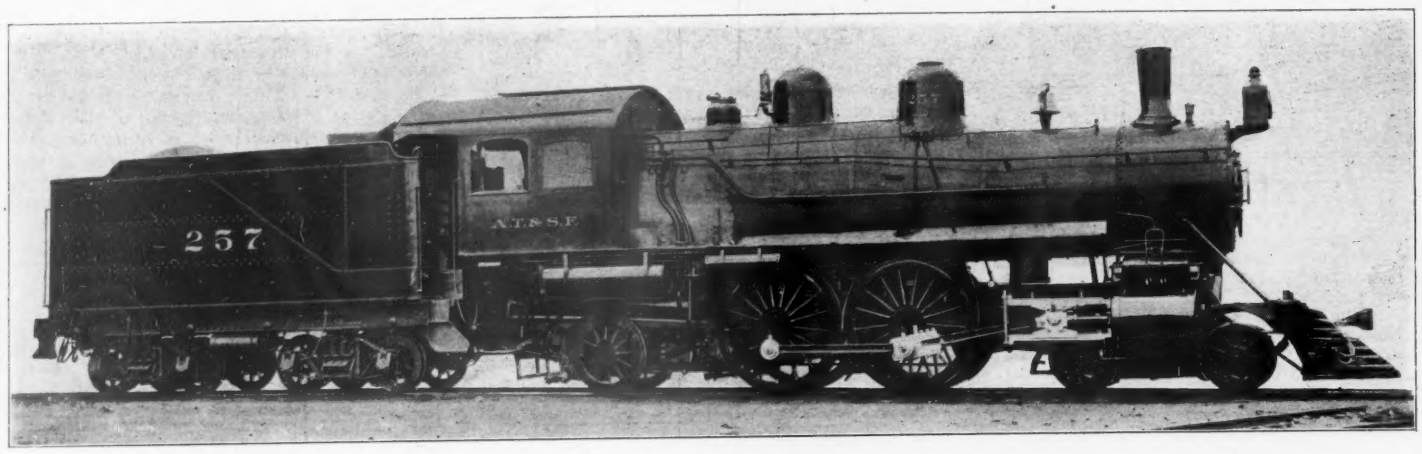
Cross Section of Station at A-B.

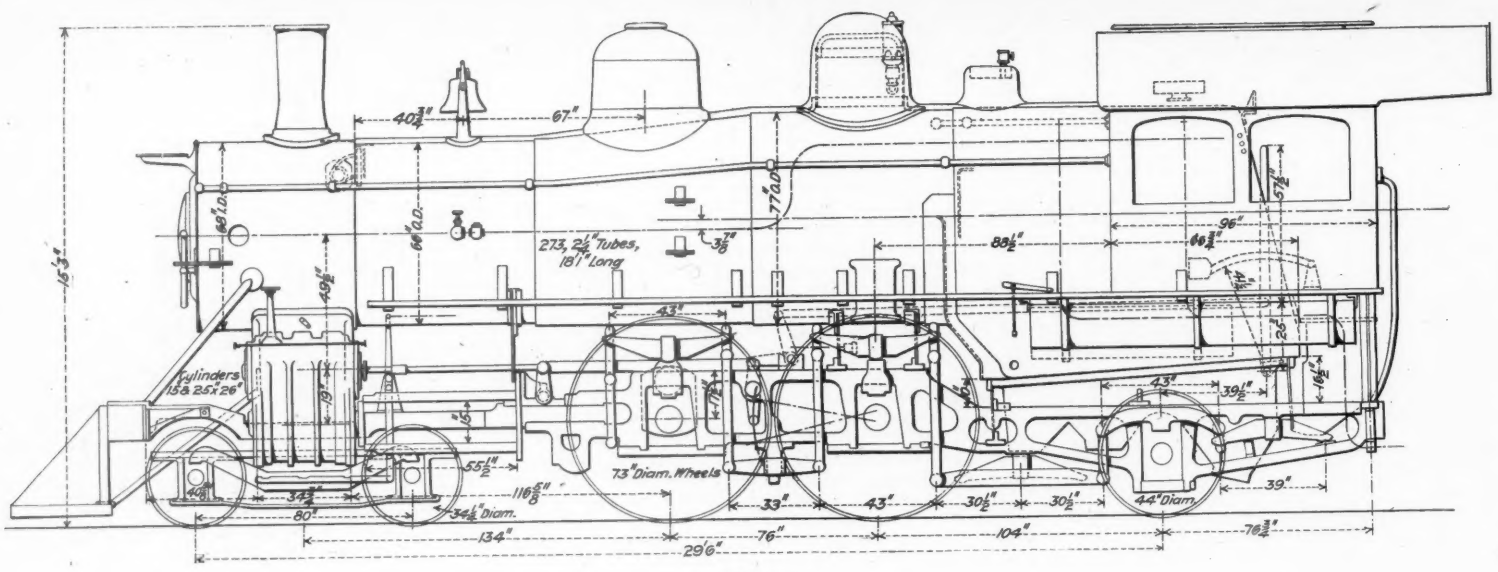



Floor Plan of Bridgeport Station at Track Level.

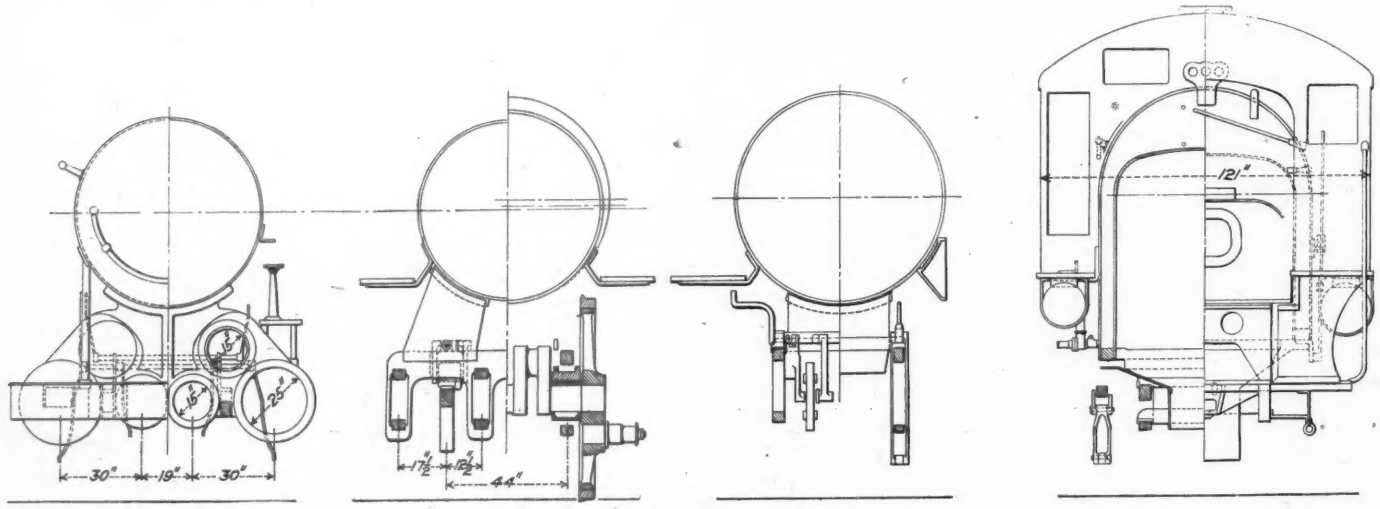


The New Bridgeport Station, New York, New Haven & Hartford Railroad.

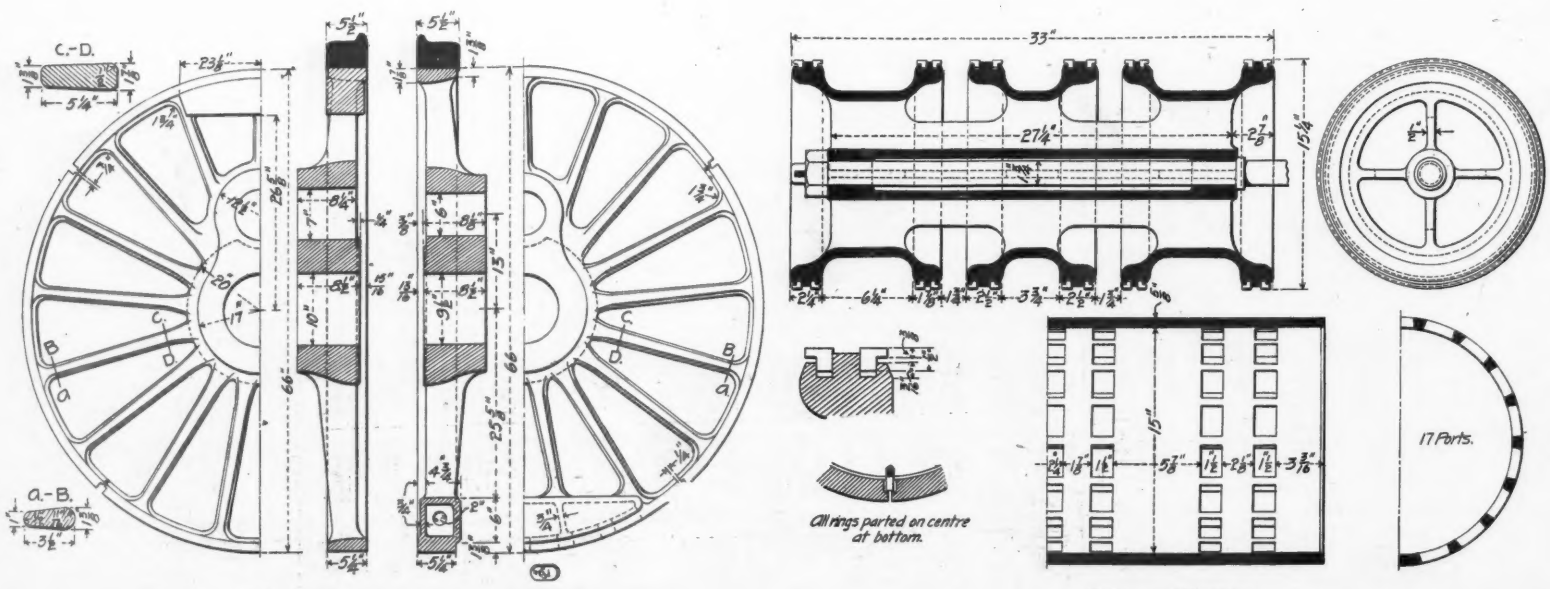



*General Elevation.*

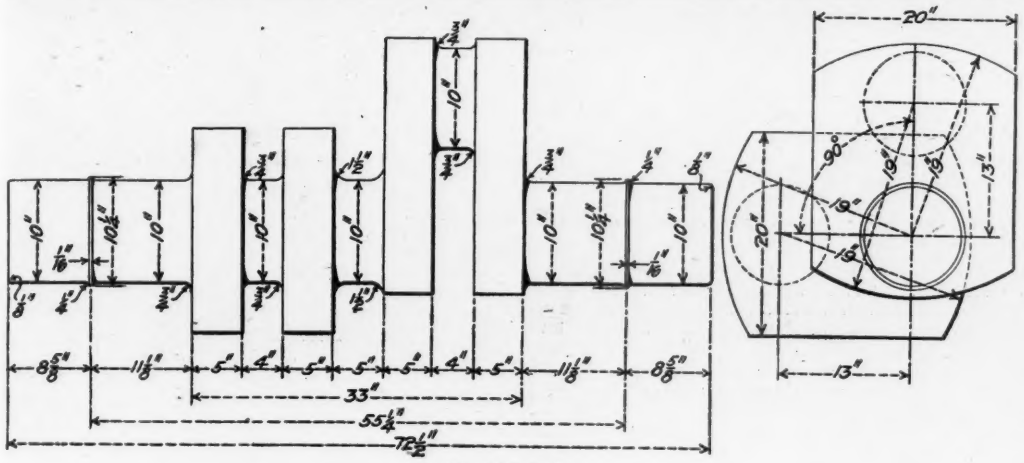



*Sections.*

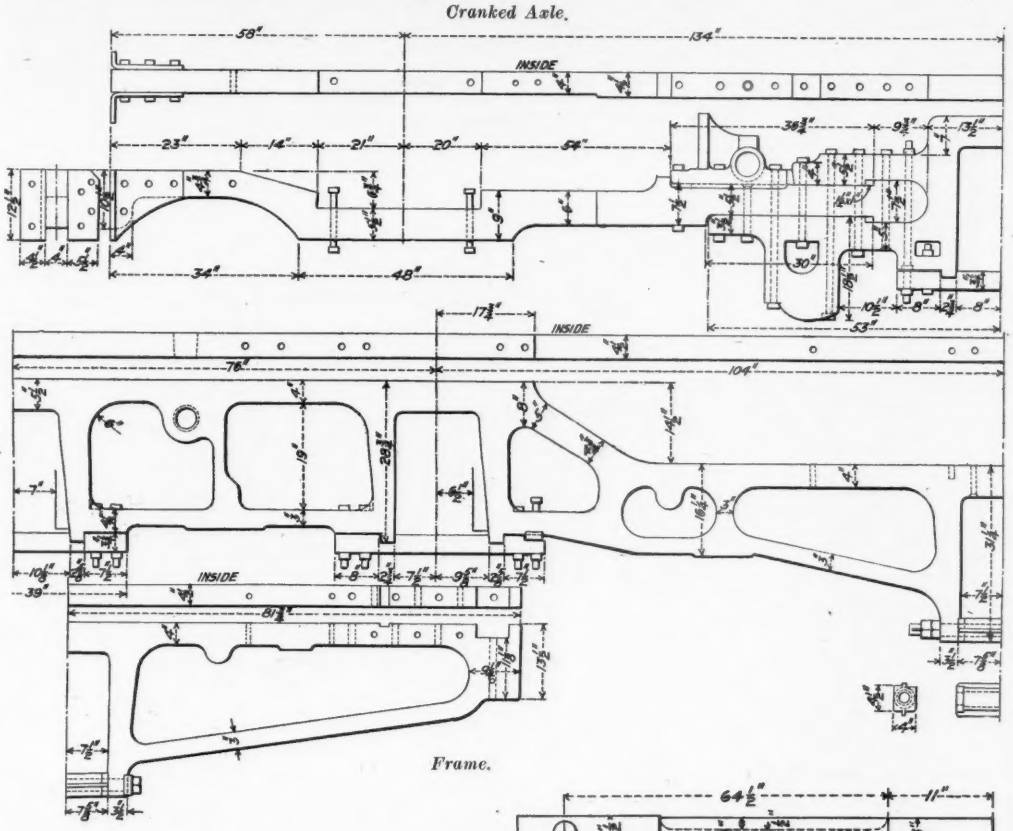



*Main Driver.* *Rear Driver.* *Valve and Bushing.*

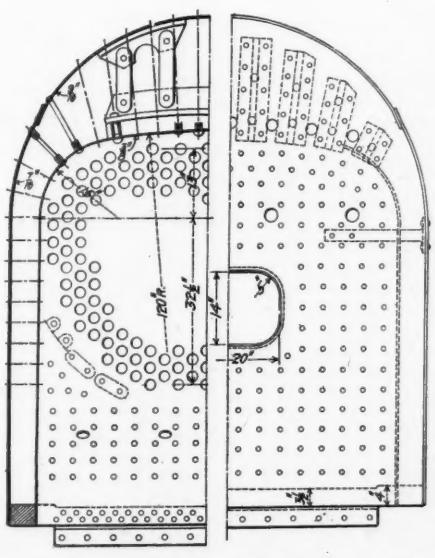
**Baldwin Four-Cylinder Balanced Compound Locomotive—Atchison, Topeka & Santa Fe.**



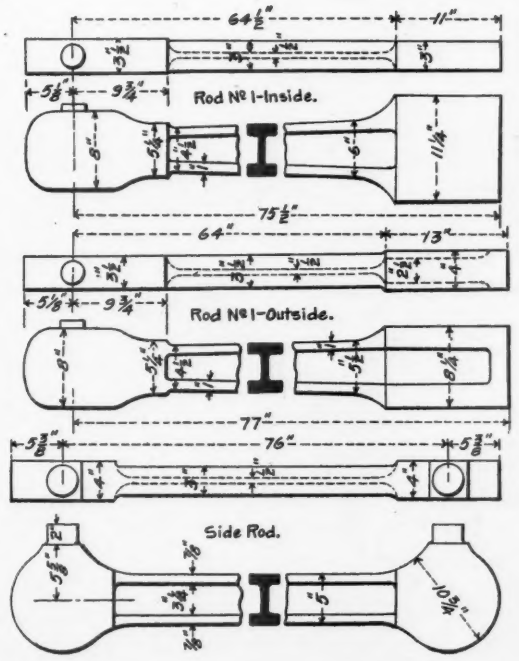
*Cranked Axle.*

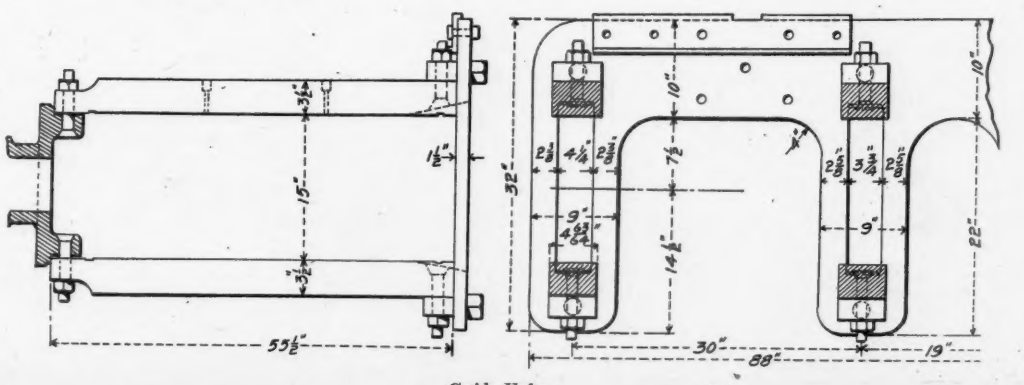


*Frame.*



*Section Through Fire-box.*





*Guide Yoke.*

**Details of Santa Fe Four-Cylinder Balanced Compound.**

## Baldwin Four-Cylinder Balanced Compound Locomotives for the Santa Fe.

The fine work of the de Glehn-du Bousquet four-cylinder balanced compounds on the Northern of France has led American and British locomotive designers to a serious consideration of this type of locomotive for high speed passenger service. Recently the Great Western of England has placed one of these engines in service and the Pennsylvania Railroad has ordered one from France upon which tests will be made at the St. Louis exposition this year. In the *Railroad Gazette*, Oct. 10, 1902, was a description of the latest Atlantic-type locomotive of the Northern of France. At that time the principal features of the de Glehn-du Bousquet locomotives were pointed out as follows: "The main points to be observed in examining this system of compound engine are, the arrangement whereby live steam can be admitted to the low pressure cylinders while running at any speed; driving by two axles; independent reversing gear for each cylinder, and, of course, the disposition of the cylinders in such a way as to get practically complete balance." In the American adaptation of this design, however, some of the complications have been eliminated. All cylinders are placed in the same vertical plane and one valve serves each pair of high and low pressure cylinders. In the French engines the high pressure cylinders are outside the frames and the low pressure cylinders are inside the frames. In the American adaptation this arrangement of the cylinders is reversed and all four cylinders drive on the forward axle. In the *Railroad Gazette*, Feb. 28, 1902, was a description of a four-cylinder balanced compound, built by the Baldwin Locomotive Works for the Plant System, but which was ultimately sold to a Western road. The Plant engine was the 10-wheel type. The principal dimensions of this locomotive, the Atlantic-type engine of the Northern of

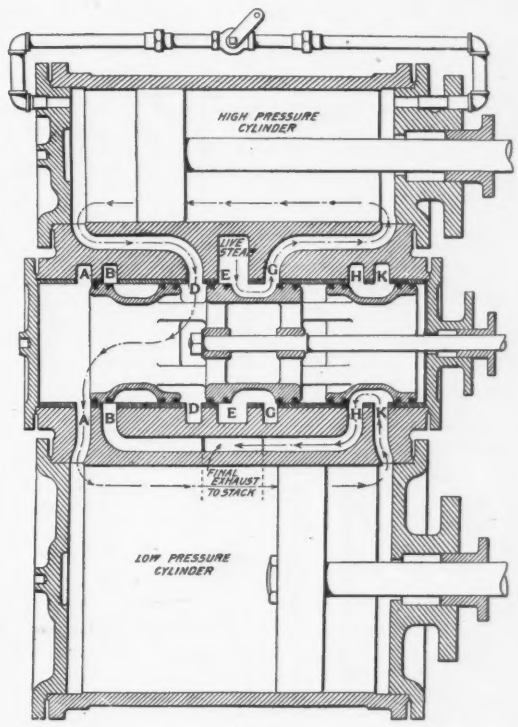



**Diagram Showing Course of Steam Through Cylinders of Santa Fe Compound.**

France and the Atlantic-type locomotive of the Santa Fe, which is the subject of this article, are given in the following table:

| | Plant System. | Northern of France. | Santa Fe. |
|---|---|---|---|
| Total weight, lbs... | 176,510 | 142,193 | 193,760 |
| Wgt. on drivers, lbs. | 127,010 | 71,200 | 101,420 |
| Cylinders, in. ..... | 15 & 25 x 26 | 13.4 & 22 x 25.2 | 15 & 25 x 26 |
| Heating surf., sq. ft.. | 2,793 | 2,274 | 3,083 |

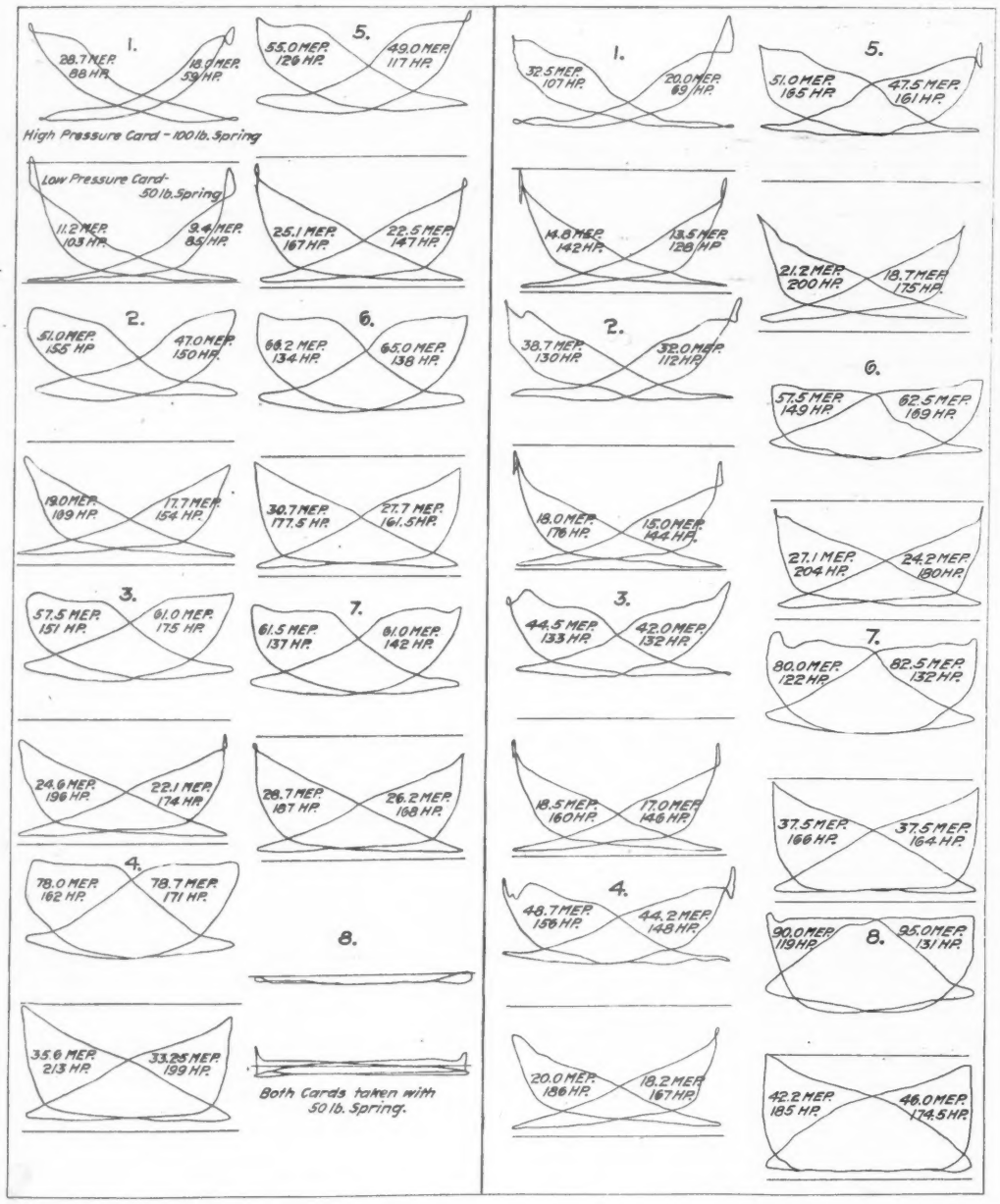
The Santa Fe engines are now in use hauling some of the trans-continental trains between Chicago and Ft. Madison, Iowa. The trains consist of from 8 to 12 cars. On some trains there are four or five express and mail cars, usually heavily loaded, and on other trains there are several Pullman sleeping cars and 70 ft. chair cars. The engines are replacing chiefly 10-wheel Dickson locomotives having 123,000 lbs. on the drivers, 2,148 sq. ft. of heating surface, 180 lbs. boiler pressure and a tractive force of about 20,000 lbs. The 10-wheelers had difficulty in maintaining speed requirements chiefly on account of limited boiler capacity. It was thought that for an 8 or 10-car train over this division an Atlantic-type engine would have sufficient tractive force and the larger wheels would permit greater speed. Furthermore the large boiler would increase the steaming capacity. The grades on this division are comparatively light—the most numerous ruling grades ranging from 25 ft. to 31 ft. per mile and a few being 40 ft. to the mile.

This run of 237 miles is made on a six-hour schedule with five stops averaging five minutes each. On several occasions this run has been made in a little less than five hours. Deducting stops and allowing for time required in accelerating, brings the running speed close to 60 miles an hour. On this trip from 6 to 9 tons of Illinois coal and from 16,000 to 20,000 gal. of water are used, no attention

being given to the fire or ash pan during the entire run. In the few months that the engines have been in service there have been no apparent defects, except occasional trouble with the crank axles running warm. The speed of these engines has been increased from 40 to 60 miles an hour with 10 heavy passenger cars on a grade of 26 ft. per mile in a distance of 10 miles.

One of the illustrations herewith given shows the course of the steam in the cylinders. Live steam enters the right side of the high pressure cylinder through the ports E and G, and forces the piston towards the left. The exhaust steam on the left side of the piston is forced out through the port D into the interior of the valve and valve chamber and enters the left side of the low pressure cylinder through the port A. The final exhaust from the low pressure cylinder passes out through the ports K and H which connect with the exhaust pipe.

The accompanying indicator diagrams were taken during tests of one of these engines. In test No. 1, the load consisted of 10 cars. In test No. 2, the load was 8 cars. In test No. 1, the valves were set to give 1/8 in. lead at 18 in. cut-off in the high pressure cylinders and 1/4 in. lead at 14 in. cut-off in the low pressure cylinders. In test No. 2, the right back up eccentric blade was shortened 3/64 in. in order to even up the cards at a short cut-off. The following tables give the data for each test:




*Test No. 1.* *Test No. 2.*

**Indicator Cards From Four-Cylinder Balanced Compounds—Atchison, Topeka & Santa Fe.**

*Test No. 1.*

| Card No. | Speed. | Boiler pressure. | Cut-off, in. | Throttle opening. | I. H. P. | Grade, ft. |
|---|---|---|---|---|---|---|
| 1 | 62 | 210 | 10 | ½ | 670 | — 16.4 |
| 2 | 60 | 215 | 14 | ½ | 1,256 | 0 |
| 3 | 54 | 210 | 16 | ½ | 1,400 | — 10.5 |
| 4 | 41 | 215 | 17 | ½ | 1,490 | + 26.4 |
| 5 | 45 | 200 | 14 | ½ | 1,114 | 0 |
| 6 | 40 | 205 | 14 | ½ | 1,222 | 0 |
| 7 | 44 | 200 | 16 | .. | 1,148 | + 26.4 |
| 8 | 51 | | Drifting | | | — 58.1 |

*Test No. 2.*

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | 62 | 215 | 13 | ½ | 892 | 0 |
| 2 | 66 | 212 | 14 | ½ | 1,128 | — 13.7 |
| 3 | 59 | 190 | 14 | ½ | 1,142 | + 18 |
| 4 | 63 | 215 | 16 | ½ | 1,314 | — 16 |
| 5 | 61 | 205 | 17 | ½ | 1,400 | 0 |
| 6 | 51 | 190 | 17 | ½ | 1,404 | + 26.4 |
| 7 | 30 | 210 | 18 | ½ | 1,168 | + 58 |
| 8 | 26 | 215 | 19 | ½ | 1,220 | + 59 |

The revolving parts of each wheel are carefully counterbalanced with reference to that wheel only. That is, the main wheel interior parts consisting of the crank axle, etc., are balanced as nearly as possible by the main wheel exterior revolving parts consisting of the crank pin, crank pin hub, etc. A small counterweight is used only to make up the difference between these two. In other wheels the revolving parts are balanced in the usual way by a counterweight placed opposite. The reciprocating parts act in opposite directions at the same instant and will therefore practically balance each other.

A general description follows:

| | |
|---|---|
| Fuel | Soft coal |
| Weight on drivers | 101,420 lbs. |
| Weight on truck | 46,720 lbs. |
| Weight on trailing wheels | 45,420 lbs. |
| Weight, total | 193,760 lbs. |
| Weight, tender, loaded | 154,240 lbs. |

*General Dimensions.*

| | |
|---|---|
| Wheel-base, total, of engine | 29 ft. 6 in. |
| Wheel-base, driving | 6 ft. 4 in. |
| Wheel-base, total, engine and tender | 58 ft. 3½ in. |
| Heating surface, fire-box | 190 sq. ft. |
| Heating surface, tubes | 2,893 sq. ft. |
| Heating surface, total | 3,083 sq. ft. |
| Grate area | 49.5 sq. ft. |

*Wheels and Journals.*

| | |
|---|---|
| Drivers, number | 4 |
| Drivers, diameter | 73 in. |
| Truck wheels, diameter | 34¼ in. |
| Trailing wheels, diameter | 44 in. |
| Journals, driving axle | 10 in. x 11 in. |
| Journals, truck axle | 6 in. x 10 in. |
| Journals, trailing axle | 8 in. x 12 in. |

*Cylinders.*

| | |
|---|---|
| Diameter | 15 in. and 25 in. |
| Stroke | 26 in. |

*Valves.*

| | |
|---|---|
| Kind of | Balanced piston |
| Diameter | 15 in. |

*Boiler.*

| | |
|---|---|
| Type of | Wagon top |
| Working steam pressure | 220 lbs. |
| Thickness of sheets | 11/16 in. and 13/16 in. |
| Diameter | 66 in. |
| Crown sheet stayed with | Radial stays |

*Fire-box.*

| | |
|---|---|
| Length | 107 15/16 in. |
| Width | 66 in. |
| Depth, front | 75⅞ in. |
| Depth, back | 67⅝ in. |
| Thickness of sheets: | |
| Sides, ⅜ in.; back, ⅜ in.; crown, ⅜ in.; tube, 9/16 in. | |
| Water space | Front, 4½ in.; sides, 5 in.; back, 4 in. |

*Tubes.*

| | |
|---|---|
| Number | 273 |
| Material | Iron |
| Outside diameter | 2¼ in. |
| Wire gage | No. 1 |
| Length | 18 ft. 1 in |

*Tender.*

| | |
|---|---|
| Wheels, number | 8 |
| Wheels, diameter | 33 in. |
| Journals | 5½ in. x 10 in. |

## Compressed Air Power Plant at the St. Louis Exposition.

The central power plant for supplying compressed air at the St. Louis Exposition will contain two main compressing units. One will be a cross-compound, two-stage, Cincinnati-gear compressor having 13-in. and 24-in. steam cylinders, 22-in. and 14-in. air cylinders with a common stroke of 24 in. and a displacement of 1,300 cu. ft. per minute at 125 r.p.m. The other unit to be installed is a cross-compound, two-stage, Meyer-gear compressor, 12-in. and 20-in. steam cylinders, 18-in. and 11-in. air cylinders and a common stroke of 18 in. with a displacement of 530 cu. ft. per minute at 100 r.p.m. The first machine is to supply compressed air for the general requirements of the Exposition, while the second is to supply the transportation exhibits. The larger machine is of special interest as being the first compressor of its type, publicly exhibited, although a number of similar machines have been installed in industrial power plants. A 2,800-ft. compressor of this type is now being placed in the Jersey City power house of the Central Railroad of New Jersey.

The general features of construction of one of these machines are shown in Fig. 1. The frames are massive, with a long bearing on the foundation and the steam and air cylinders, which are joined in the direct line of thrust by heavy cast-iron housings, are also supported by bed plates under their entire length. The weight of each side is thus taken on two large bearing surfaces extending to the ends of the machine, and this avoids the objectionable features of over-hung cylinders and also gives the compressor great stability on the foundation. The details of the machine are characteristic of the highest grade engine work. It has removable quarter boxes and main bearings, steel forged connecting rods with wedge take-up, specially large crank and wrist pins and cast steel cross heads with adjustable babbitted slippers, top and bottom, working in bored guides. The simplicity of design of the reciprocating parts permits low reciprocating weights without sacrifice of strength and the satisfactory balance obtained, together with the long bearings on the foundation gives a very easy running machine.

The steam valve gear is of the four-valve type. The steam distribution is effected by means of short, double-ported, slide valves, working at both ends of the steam chest on a valve face as close as possible to the cylinder bore, the clearance volume being restricted as far as the large valve area will allow. The exhaust valves are of the Corliss rotary type and are placed at the bottom of the cylinder. This construction has been followed in order to produce a valve gear having the essential advantages of a Corliss gear without the complicated Corliss releasing gear which is not suited for even moderate speeds. Seperate passages for the steam and exhaust with corresponding reduction in cylinder condensation, short, straight steam ports and small clearance are all secured with the modified gear used on these machines combined with a positive mechanical action.

The air valve gear is the distinguishing feature of this machine, combining in an ingenious manner the positive action, noiseless operation and durability of the mechanically moved valve with the elasticity of the poppet valve. The noise and rapid wear of the poppet valve, due to the impact of the valves closing at the reversal of stroke, is eliminated by mechanically closing the passages underneath the poppet valve, and leaving a cushion of air upon which the latter seats. The action of the valve gear is clearly indicated by Fig. 2, showing the general arrangement of the cylinder, and Figs. 3 and 4, showing the position of the valve at different points of the stroke.

At the beginning of the forward stroke of the piston, the mechanical valve A as shown in Fig. 3, is just closing the port B, the discharge edge of A being line in line with the upper edge of the port B, and the valve moving in the direction shown by the arrow C. After the piston advances a short distance, the valve has reached the position shown in Fig. 4, in which the inlet edge of the valve D is just coming in line with the lower edge of port B. The valve continues to move in the direction of the arrow C until about mid**stroke, when it** reverses to the direction shown by arrow **E** bringing the valve back to the same position as shown in **Fig. 4** at the end of the stroke. On the return stroke, the valve still moving in the direction of the arrow **E returns** to the position shown in **Fig. 3**, the discharge edge of valve **A** being in line with the upper edge of the port **B** and about to open.

After the mechanical valve opens, the poppet valves **G**, which have had the entire return stroke in which to seat, prevent the flow of air back from the discharge passages to the cylinder, and remain closed until the pressure in-

side the cylinder slightly exceeds the pressure in the discharge passages. The poppet valves G thereupon open and remain open until the end of the stroke, when the valve A, which in the meantime has changed its direction to that shown by arrow C, has resumed the position shown in Fig. 3, thus leaving a volume of air under discharge pressure in the space between the mechanical valve and the poppet valve, permitting the light springs back of the poppet valves G to seat them easily and gently during the return stroke. The three fixed points in the compression cycle, namely, the opening of the inlet, the closing of the inlet and the closing of the discharge are positively and mechanically controlled; the opening of

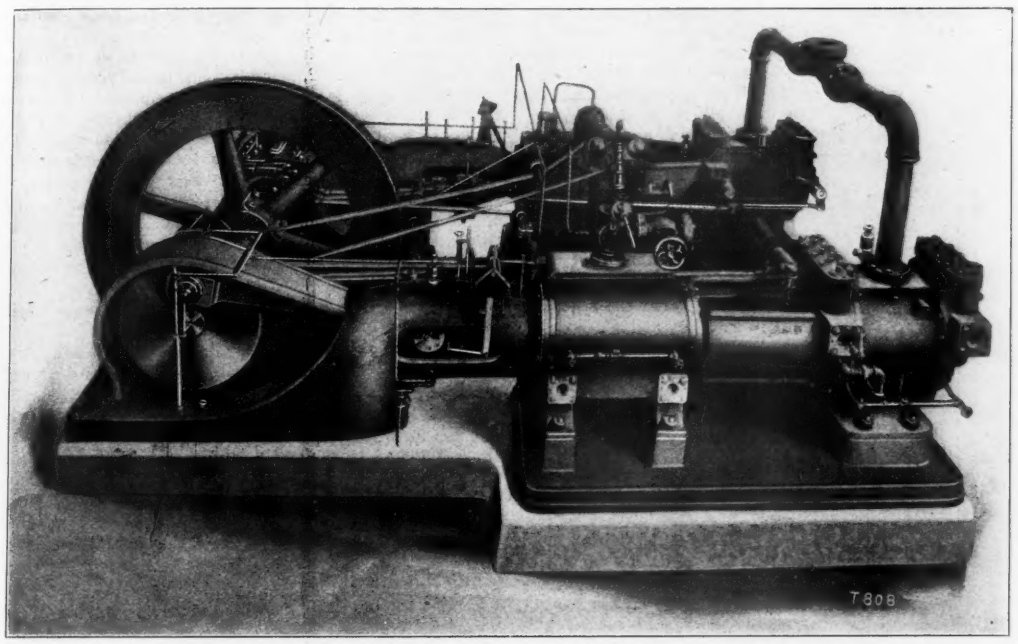



Fig. 1.—Cincinnati-Gear Air Compressor for the St. Louis Exposition.

the discharge, which is the only variable point in the cycle, is controlled by the automatic poppet valves, which are relieved, however, of the necessity for quick closing, and are consequently free from the objectionable features of noise and rapid wear.

Cards from one of these machines, operating at a speed of 150 r.p.m., show a steep expansion line on the air

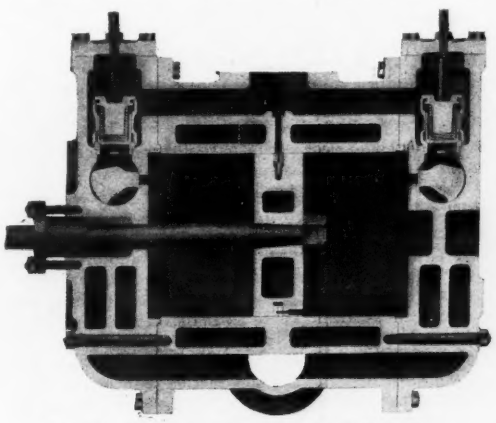


Fig. 2.—Section of Air Valves and Cylinder.

cards, indicative of the small clearance and high volumetric efficiency of the machine. The large valve area is shown by the practical coincidence of the inlet and atmospheric lines and by the uniform discharge line. The rounded admission of the steam cards, which might, in ordinary engines be deemed objectionable, is due to the maker's practice of giving the steam valves a slight negative lead to offset the expansion pressure at the beginning of the air cards. These machines are built by the Laidlaw-Dunn-Gordon Company, Cincinnati, Ohio.

## Economy in Railroad Operations.*

Having had charge of the maintenance of equipment accounts of a large company for a number of years, an excellent opportunity was found during the hard times from 1893 to 1897 to study the subject of economies, as every item of expense was carefully examined with the idea of greater economies. The results showed most conclusively that something can be done along the line of more complete accounting and reduction of expenses. . . .

A bureau of economies must be general in its character, directly under the supervision of the general manager. It will be an office of record, and the head of the bureau will have no executive authority whatever. Here, in my opinion, lies the secret of the success or failure of such a bureau, which must be entirely co-operative and advisory in its conception, organization and administration. It must not interfere with the responsibilities or authority of any executive officer in charge of a department. With a man that can see without spying, can hear without sneaking, that can co-operate and advise without interfering—with such an official head to the bureau, it could be of enormous value. The organization should be as simple as possible, having for a large company: A head of the bureau, an assistant in charge of transportation economies, an assistant in charge of maintenance of equipment economies, an assistant in charge of maintenance of way and structures economies, and a chief clerk to co-operate with the three assistants. On a small line, the head of the bureau could look after all departments, but this would not be possible on the large organizations we have to-day. Standing committees should be organized, composed of the superintendent of the department as chairman, the head of the Bureau of Economies, and the official next in line to the superintendent of department. For a transportation division, the committee should consist of the superintendent of the division, head of the Bureau of Economies, or assistant in charge of transportation economies, and official next in line to superintendent.

The head of this bureau should be constantly in touch with all operating details and operating officials; he should suggest to the heads of departments any points he may observe that could be investigated to an economical advantage, and particularly look for suggestions from such official heads. Where a general office is concerned in

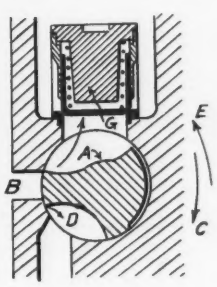



Fig. 3.

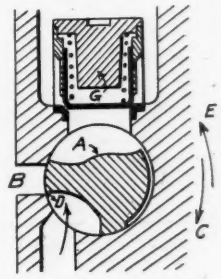



Fig. 4.

direct operation, as general superintendent or general superintendent of motive power, these officials should be ex-officio members of the committees, advised of all that is being done, and acting on the committees if they so desire.

The bureau should collect and keep a complete record of all operating statistics and expenses. In the case of special investigations, it should furnish all clerical labor if necessary, and co-operate directly with the official in charge. The results are for the head of the department, and it is for him to decide upon the course to be followed in carrying out any recommendations of the committee. Only in this way can be preserved the dignity and responsibility of the operating official, and make the bureau something to be used and appreciated. Any system of spying is disgraceful and disorganizing; it can only lead to bad results in the end, both to the department and the official in charge.

The head of the Bureau of Economies should report directly to the general manager, who is thus fully advised of what has been done. The head of any department concerned in the report must therefore advise the general manager of the action taken, either that the recommendations have been acted upon, or reasons given for not acting. The general manager sees wide discrepancies in operating expenses on different divisions; the bureau can look into them and would find, probably, bad accounting in some cases, in others bad management.

On all railroads, it is safe to say, there is more or less bad accounting. The auditors are usually satisfied if reports are on time and balanced up correctly, but whether care has been exercised in the distribution of labor and material to the proper expense accounts is a matter about which an auditor cannot know, unless someone from the accounting department is constantly in touch with the clerks in direct charge of the distributions. . .

A new general shop was built that was not to be attached to any particular division, and at my solicitation, the superintendent of motive power obtained from the general manager his consent to put the shop on the basis of a private industry; i. e., the plant exists for the production of work. Charge everything about the plant to the work, and bill other shops for all work done. The result was that the costs at this shop appeared to be from 40 to 60 per cent. greater than at any of the others. I say appeared, because in reality the cost was less—it was a case of accounting, as other shops never were able to get at the true costs, and I had great difficulty in proving it to the master mechanics. A large number of items are made at railroad shops that can be purchased cheaper outside, if their actual costs were known, but many master mechanics will say that flat cost and ten per cent. is close enough to real cost, for the statement that the shops can make a thing cheaper than it can be bought—forgetting that heat, light, power, handling materials, general labor, shop repairs, supervision, etc., are all legitimate parts of the cost per unit. A manufacturing plant that did not take these items into consideration in figuring cost would be bankrupt in a year. . . .

The Bureau of Economies involves a close connection with all the producing elements, and its head and assistants should have such familiarity with the work as to be able to intelligently discuss any details involving questions of economy with the heads of departments. The Bureau must be prepared to meet the demands of a large variety of interests after sufficient time has been allowed for its complete organization. The final form and extent of this Bureau must necessarily be determined by experience and any preliminary outline must be provisional. The Bureau will be subject to constant change, amplification and improvement in detail, as the progress of the work permits or compels, until the adjustment to the requirements becomes perfect. . . .

Our Bureau also could be of great help in the adjusting of labor questions. An element that is aside from the immediate control of labor can handle questions of differences much better than those in direct supervision, and the reason for this is that the outside man feels he can afford to be on the generous side, and experience has proven that the generous side will win in the end. . . .

The Bureau would have records of the rates paid at various points, and, when possible, on other roads; would be familiar with the conditions at each shop or on each division; would have the time to thoroughly investigate complaints, and more than likely be able to convince the men if the complaint is not a fair one, and thus settle the matter.

Many times dissatisfaction comes through bad conditions and unfair treatment at the hands of foremen. In many cases the conditions and the unfair treatment are imaginary, and the shop officials are apt to ignore such complaints without trying to settle them thus sowing the seed of deeper discontent. Our Bureau, ever on the watch for such things, would step in and heal the trouble before it could ever get to such a serious point as a strike.

The wage-earner is also disturbed by the fallacious array of one-sided statistics put forward by the agitators and some socialistic writers. The fact is either not known, or ignored, that the laborer is better paid and able to get more physical comforts, together with a better education for his children, than ever before in the history of the world.

*A paper presented to the January meeting of the Western Railway Club by W. B. Waggoner.

## Foreign Railroad Notes.

The portions of the Prussian State Railroads where there is danger of setting fire to woods or heather are to be designated by painting the telegraph poles white for about a yard on a level with the engineman's eye.

The representatives of the union of Swiss railroad employees petitioned the State Railroad authorities to limit as much as possible contract work in the shops. The authorities respectfully declined.

In Germany experiments have been made with wireless telegraphy between a station and a moving train. Communication was kept up over a distance of four miles. This is less than was accomplished a few months ago on the Grand Trunk Railway of Canada.

The long railroad which the Russians are building in Asia south of Siberia from Orenburg southeast to Tashkend, where it will connect with the Asiatic Midland, whose sole outlet now is by the Caspian Sea, has been making good progress through the grazing country south of Orenburg, and trains have been running a considerable distance during the summer and fall. It is reported that the authorities purpose suspending the train service during the winter on account of the obstructions from drifting snow in a very thinly peopled country, which naturally needs very few trains; but the Orenburg people protest that this may cause a famine on the Kirghise steppe, where the grain crops failed this year, as they frequently do in semi-arid countries. The remarkable thing about this is that a country which for all time has been dependent upon its own resources should in a few months become dependent upon railroad transportation.

## A Study of Failures of Re-enforced Concrete.

*By* JULIUS KAHN, *C. E., Assoc. M. Am. Soc. C. E.*

There have been so many failures in re-enforced concrete buildings of late that it becomes a matter of importance and self-protection for every engineer and architect designing in this type of construction to reflect and study their cause. If this construction is all that has been claimed for it by men of prominence, if large and important works of engineering have been successfully and economically accomplished, then, indeed, re-enforced concrete has come to stay and the engineer must awaken to its study, that he may hold his position in the line of progress of the engineering world. If, on the other hand, this type of construction is unscientific and theoretically unsound, then, indeed, it is his duty to condemn it and exert himself towards its non-adoption.

The writer has given this subject considerable study and feels such perfect confidence in re-enforced concrete that he cannot bear to sit by quietly and allow what he considers a most beautiful field of construction to be ruined by the incompetence of so large a part of the men who work therein. He feels it his duty, therefore, to place his views regarding some of the failures of re-enforced concrete before the public, and he trusts that architects and engineers may agree with him, and possibly be more cautious in the design of works of this nature, and in entrusting the same to men of competence and conscience.

The failures of concrete are generally due to one of the following causes:

(1) Weak and insufficient centering.
(2) Bad material and mixing.
(3) Insufficient and improper re-enforcement.

It is, of course, of primary importance that the centering for these structures should be sufficiently strong to carry the dead weight of the concrete while it is as yet green and unset. In a number of failures which have been described in engineering journals the centering collapsed under the dead weight, allowing the heavy concrete to fall on the floors below and carrying these down with it. Such failures as these are, of course, entirely inexcusable. The writer does not feel it important to lay stress on this matter of centering; common sense alone should dictate the importance of making it sufficiently strong.

Regarding the materials used for re-enforced concrete, it is, of course, essential that these be of the very best grades. Portland cement is manufactured in this country of such excellent quality and at such a low price, tests are so readily made thereon with even the simplest appliances, that the use of poor cement is hardly excusable. As for clean, sharp sand and broken stone or gravel—these are procurable almost everywhere. Regarding the mixing of concrete, there are on the market at the present time a number of makes of very excellent machine concrete mixers; and, where conscientious workmanship exists, no reason can be given for the poor handling of materials.

The writer sincerely believes that the majority of contractors who are working in this type of construction are conscientious and that they make every attempt at good, honest workmanship. Unfortunately, however, only very few possess a scientific knowledge of the materials with which they are dealing and their work at its best is mere speculation, which, if it stays in position after loads are applied is considered successful, and if it falls down is called a failure. Such a time for judgment is late indeed and the lesson generally costs the reputation gained after a life of hard toil.

Bad materials and workmanship are the generally credited causes for the failure of concrete structures, but the writer is absolutely certain that in the majority of cases where our leading engineering journals have held out in this manner, the causes were of a different nature. Let us consider for a moment some of the types of re-enforcement used for long span floor systems at the present day. Among those most prominent are expanded metal, wire cloth and plain or deformed rods.

Regarding the first two of these constructions, the writer has come into repeated contact with standard floors about as follows: Spans, up to 22 ft.; thickness of floors, 5 in. and 6 in.; material, cinder concrete; area of re-enforcement per foot of linear cross section of floor, $^3/_{16}$ in. to ¼ in.; the floors being in the majority of cases a single slab. If a floor of 22 ft. span were made of 6-in. I beams placed side by side as closely as their flanges would allow, and such a floor subjected to the ordinary lightest live loading, together with the plaster and wood floor, the same would deflect from ⅜ in. to ¾ in. And yet, these concerns who pretend leadership in re-enforced concrete constructions have built them repeatedly of concrete, re-enforced as above, even using cinders instead of stone, and producing concrete with only one-half the strength of stone concrete. Are failures of such constructions as these to be made the argument for the abolishment of re-enforced concrete? If, on the other hand, constructions like these do stand, as is the case with but few exceptions, then, indeed, we may expect in scientificially constructed works of this nature wonderful possibilities; and, for the progressive engineer, a new field has opened wherein he may design with greater economy than he has ever done heretofore; where his structures may have the permanency of masonry and yet the strength of steel, with the fire-proof, rust-proof and rot-proof qualities of concrete, together with that wonderful property of all cement construction, its increasing strength with age.

The writer has seen floors re-enforced with expanded metal as above described, deflecting as much as 3 in., immediately on the removal of centering, after the concrete had been allowed to set for a month or more. How it could possibly do otherwise than deflect was to him more of a problem than that it should fall down. In spans where the writer should deem it necessary to insert at least ¾ sq. in. of metal per running foot of floor, he has seen expanded metal floors stand up with less than ¼ sq. in. Who should be blamed for failures such as these? Is it a fault of concrete, is it poor mixing, or is it the ignorant boldness of a concern dealing in what they do not understand?

The writer knows of concrete floors 6 in. thick and 22 ft. span, with nothing more embedded therein than a wire cloth, with occasional cables of similar wire ½ in. in diameter, the total re-enforcement providing a cross-sectional area of steel per running foot of floor of about ⅛ sq. in. As already said above, even common-sense engineering should protest at a floor designed in this manner. If a floor were specified to be of such thickness and span, by all the rules in creation the writer could not calculate it strong enough with less than ¾ sq. in. of metal per running foot; and, although structures designed as above do stand, their factor of safety is probably 1½ at full loading, at rare occasions it may be 2, and sometimes a little less than 1, in which case we have the natural collapse.

Patrons of wire cloth will tell us of the high tensile strength of the wire, but only recently the writer had

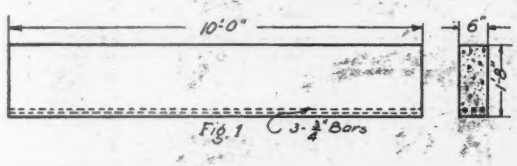


Fig. 1.

occasion to test a sample of the most largely-used brand and found its strength to be only slightly above 60,000 lbs. per sq. in.

Failures where plain or deformed rods have been used are also becoming quite common, and a little study of the method of failure will at once bring forth the large faults in design. The generally adopted arrangement of re-enforcement with rods has been to embed them along the lower edge of the concrete floorbeam for the purpose of supplying the tensional strength in which concrete itself is so largely lacking. The principle of supplying steel in this locality is proper enough, and the generally adopted methods by engineers of the quantity of steel required at the center are possibly true enough, providing the beam actually failed there at test to destruction. But the fact of the matter is, a beam re-enforced in this manner and subjected to stress, so that its shearing as well as bending strains are developed, rarely fails in this manner, and our calculations for the beam have therefore been made for the wrong place in the beam. Such a beam will invariably fail by the shearing of the concrete at the ends, diagonally from the point of application of the load, or longitudinally along the re-enforcement bars. Take for example a given beam, as shown in the figure above, wherein the re-enforcement is horizontal only. Assuming such a beam to be 6 in. wide and 20 in. deep, and to have three ¾-in. bars embedded along the bottom edge. Such a beam, if the full safe strength of the metal were developed, should have a carrying capacity of about 25,000 lbs. uniformly distributed, and if a factor of safety of 4 has been assumed, it should carry 100,000 lbs. before failure. Now regarding for a moment this beam in square, its cross-sectional area is 120 sq. in., and assuming the safe shearing value of concrete to be 50 lbs. per sq. in., the beam would only carry a safe load of 6,000 lbs. in shear, instead of 25,000 lbs., as it should do when bending moment alone is con-

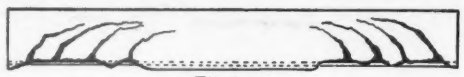


Fig. 2

sidered. The writer has made a number of tests on concrete in shear and has rarely obtained results larger than 250 to 300 lbs. per sq. in. It is evident that a beam thus re-enforced is exceedingly weak in shear.

Vertical shear is, however, not alone to be considered. The matter of longitudinal shear along the steel re-enforcement is of equal importance. In an ordinary steel girder it is generally agreed that the vertical shear is transmitted into the bottom horizontal chord within a distance equal to the depth of the girder. There is no reason to suppose that this principle does not apply with equal truth to re-enforced concrete girders, and according to this the shear of 12,500 lbs. should be carried from the concrete into the steel within a distance equal to the depth of the girder; which means that the safe adhesion between three ¾-in. bars and the concrete within a length of 20 in. should be 12,500 lbs. Ordinarily, where a large body of concrete surrounds a bar, it is safe to count on an adhesive strain of about 50 lbs. per sq. in., which would produce a safe loading of about 12,000 lbs.; but in this case the bottom of the concrete beam has been so cut up with steel that even if the required adhesion were there, the layer of concrete immediately surrounding the bars would not be capable of transmitting this strain. If the steel is to receive a stress of 12,500 lbs., the concrete must transmit the same into it within a length of 20 in. It is ridiculous to assume that a layer of concrete 6 in. wide cut up by three bars such as this is capable of transmitting safely such stress.

The general method of failure above described is, therefore, a common one, and whether the rod be plain, twisted, corrugated or bulbed adds very little to the strength of the concrete. It is the *layer of concrete* immediately surrounding the bar which is incapable of transmitting the longitudinal shearing stress, and which fails. The matter of adhesion is but a small factor in comparison with this. But, neglecting even this inability of the concrete to transmit such shearing strain, the writer has seen re-enforced concrete beams constructed by some of the leading re-enforced concrete concerns in this country, where the bottom of the beam was so cut up with twisted and otherwise deformed rods that a portion of it fell off without any load whatever being on the beam, leaving the rods entirely exposed thereby.

To take up the vertical shear, it is generally recognized that some form of vertical re-enforcement is necessary, and Hennebique, as well as other constructors in concrete, has supplied stirrups set up loosely about the rods. To the writer such stirrups seem unable to accomplish the necessary results. In the first place, shear cracks generally occur as shown in Fig. 2, being inclined to the vertical at an angle of about 45 deg. If vertical re-enforcement is necessary at all, it should cross these lines of rupture at right angles to hold together the concrete at places where the natural tendency is to open up. In the second place, if this vertical re-enforcement is to carry strains at all, it should carry the same into the bottom chord member, and should therefore be rigidly connected with the same. These two principles seem to the writer just as important of observance as the placing of steel in the bottom. Hennebique supplies the stirrups, but, in the first place, he sets them in a wrong direction, and, secondly, he makes absolutely no connection between them and the main steel bars.

To review the matter of vertical re-enforcement, therefore, it seems to the writer that designs wherein vertical re-enforcement is entirely omitted are dangerous, and where this re-enforcement is in the form of vertical stirrups, they are decidedly faulty, although perhaps not equally dangerous. In the calculation of a steel structure the engineer is very careful about the design and detail of every joint. Neglect to take into account a single connection may cause failure. Why, then, expect a re-enforced concrete construction to take its full loading when only half way re-enforced? It is true many accidents have occurred, but it is also true that the field of re-enforced concrete is remarkably new and difficult; it requires great care and accuracy, and should be handled by men of understanding only.

Would a construction engineer, under ordinary circumstances, submit the safety of his structures to the design of an ordinary layman unacquainted with the materials at hand? If he insists upon experience here, how much more so should experience and careful thought be insisted upon in the design of re-enforced concrete, where the structure is of a composite nature and everything about it is absolutely new? But the fact of the matter is that nine-tenths of the concerns now erecting buildings in this material neither employ an engineer nor have the slightest theoretical knowledge themselves in the calculation of the structures with which they are dealing.

Constructions in re-enforced concrete designed by engineers have failed but rarely because, as a rule, these men have used their technical knowledge and an inborn conservative caution in design. But where men have lacked such technical knowledge they have invariably entrusted the work to concerns which specialize in concrete, and who have been paving or sidewalk contractors before. Such contractors are not so much to blame. They have faith in a material which, if well made, has wonderful properties indeed, and they are willing to risk their all for it. But any one who entrusts this construction to them is certainly guilty of gross negligence; for the problem requires fully the same scientific study as the steel skeleton frame and demands the most skilful engineering knowledge. It seems pitiful indeed to see a contractor bear blame for the downfall of a structure such as recently occurred at Corning. The writer is acquainted with the contractor in this case, and knows that he makes no claims whatever to engineering knowledge. The concern which supplied this re-enforcement and pretended to engineer contracts wherein this is used had made fences their main business before, but suddenly discovering that steel embedded in the bottom of concrete loaned efficiency thereto, plunged deeply into the field of re-enforced concrete and hesitated at no constructions, no matter how difficult or how scientific.

Another matter wherein engineers are possibly at fault is the careless manner in which formulas are sent about by some parties with the assurance that structures will be safe if they are designed in accordance with them. On a recent occasion the writer visited the engineering office of one of the leading railroads, where, in order to satisfy themselves regarding the uses of re-enforced concrete for culverts and the accuracy of the formulas advanced by some well-known concerns, a number of experiments had been made, using one of the generally accepted types of deformed rods. Beams were designed for safe loads of 20,000 lbs. It had been assumed in their calculation that the steel was to carry the entire tension of the beam and naturally fail at test to ultimate destruction. The beams failed with loads in the neighborhood of 21,500 lbs., showing a factor of safety, therefore, of a little above 1, instead of 6 or 7 as should be required for such structures. These beams were built with the usual horizontal re-enforcement only; not even stirrups had been recommended. A single one of some 20 or more similar tests recently published in one of the leading engineering journals, made at a well-known university on 8-in. x 12-in. re-enforced concrete beams, 11-ft. span, showed failure at 18,700 lbs. The safe strength according to generally adopted formulæ, if the steel had been strained to its complete tensile strength, should have been about 8,000 lbs., showing a factor of safety a little above 2. In all of these cases the beams

failed, shearing the concrete as usual long before the ultimate strength of the steel came into play.

The writer does not believe, however, that the failure of beams re-enforced in the usual manner, at a load less than the theoretically calculated load, is as bad as the fact that the concrete has failed in preference to the steel re-enforcement. He believes that a test structure should fail by the parting of the steel. Concrete, as well as all masonry, is granular and brittle, and fails invariably by a sudden collapse in shear. In order that a structure should carry a moving load, especially in railroad work, it should be an elastic structure capable of yielding under strain, and of large deflection before destruction. For this very reason an engineer does not allow a high-carbon steel to be used in steel bridge construction, subjected to rapidly shifting loads. If the concrete carries an undue proportion of strains, and if this is a brittle material, then indeed such a construction is dangerous where subjected to sudden impact. It is like dropping an anvil on a cube of glass. If, on the other hand, the principal stresses are taken up by the steel, and if the concrete is subjected to compression alone, and if it is known that at ultimate destruction such a structure fails by drawing the steel in two at place of maximum bending moment, then indeed we have an elastic structure. Good mild steel will stretch as much as 20 per cent. of its length before failure, and a structure properly re-enforced so that slipping of steel is impossible, and where shear, both vertical and longitudinal, is well provided for, should deflect as much as 12 in. or more before failure, depending entirely on the span and depth of beam. Such a construction as this would possess the rigidity of concrete together with the elasticity of the steel. It would have resistance, and give ample warning before failure when overloaded. Such construction alone seems safe to the writer for use on building and railroad work, and any construction wherein concrete fails by shear is most decidedly dangerous. Almost any structure that can be built of steel can be erected in re-enforced concrete sometimes at an economy of as much as 50 per cent. All of the advantages of steel may be obtained without any of the disadvantages, if concrete is properly re-enforced; and combined with these advantages, are the beautiful and remarkable properties of the permanency of good concrete.

If in a structure costing 20 or 30 thousand dollars a saving has been made of from 5 to 10 thousand, would this not be ample to pay for the employment of a good, careful inspector? Why do we insist on a mill inspector, a shop inspector and a building inspector for steel work, and on the other hand allow sidewalk contractors to erect our most costly re-enforced concrete structures? Whoever turns responsible scientific work over to a man lacking knowledge of the materials with which he is dealing is just as much, and even more, to blame.

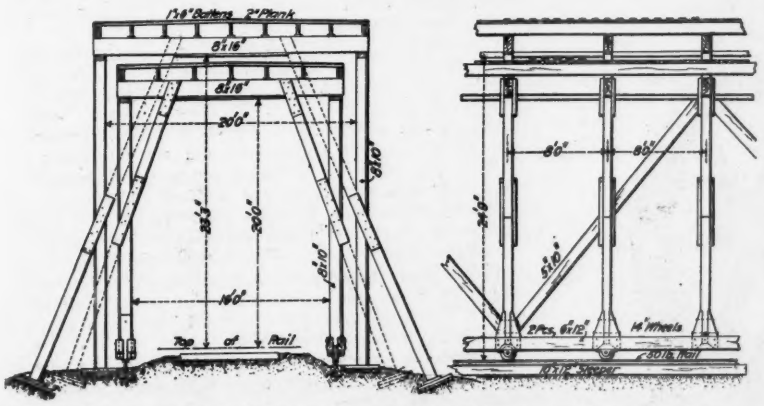
Although the writer lays great stress on the nature of the materials used, and their mixing, he believes that the matter of re-enforcement is a dozen times more important; and he ventures to say, that even the poorest mixture of concrete, if it were properly re-enforced, would carry large loads before failure. Under safe loading the concrete should not be stressed more than 400 lbs. per sq. in. in compression, and a mixture must be very weak indeed which will not stand four or five times that weight. If the nature of the re-enforcement be such that the concrete is subjected to compressive stress only, and the steel takes all tensile strains whatever their location may be, then failure seems almost impossible under safe loading.

In concrete structures erected by the writer, the centering has at times been removed with perfect safety at the end of three days. Surely the concrete had not set to sufficient hardness to carry heavy strains other than compression in that length of time. Tension and shear had been entirely provided for in those, and the writer knew very well that even at the end of three days the concrete had sufficient hardness to carry 300 or 400 lbs. per sq. in. in compression, and, therefore, the safe load.

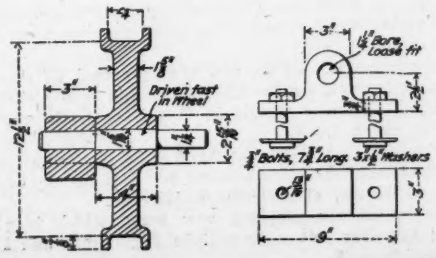
Proper re-enforcement is the first essential; good material and mixing are only secondary as compared with this. The writer has embedded his system of re-enforcement in a beam of ice of 14 ft. span, and otherwise the usual dimensions of a concrete beam, and then imposed heavy loads thereon. Surely, great shearing and compressive resistance were lacking here; surely even the poorest mud concrete should equal this construction, and yet the beam stood up like a rock under loading. Is this sufficient proof that proper re-enforcement has something to do with the safety of re-enforced concrete structures?

Telescopic Snow Shed With Gap Left Open.

Telescopic Snow Shed on the Central Pacific—Partly Closed.




Sectional View of Telescopic Shed. Removable Bracing Indicated by Dotted Lines.




Detail of Carrying Wheel.

## Telescopic Snow Sheds on the Central Pacific.

Among the many difficulties encountered by the early railroad builders of the west was the heavy and long continued snow fall in the Sierra Nevada Mountains of California which, in some winters, aggregates 60 ft. in depth. The history of the invention of the snowsheds by the engineers of the Central Pacific is already well known, and reference has frequently been made to the developments made, as a result of experience with the peculiar conditions, which could not easily have been foreseen. The snow-sheds, extending from Blue Canyon station almost to Truckee, were first built, as naturally suggested itself, with steep roofs, and in section somewhat resembling an ordinary house, but it was later found that the unbalanced weight of the snow on one or the other side, especially on side hill work, caused continual trouble by throwing them out of line down hill.

The next step was to anchor the snow-sheds back to the side hill with heavy rods attached to the framework of the shed and sulphured or otherwise secured to the rock or earth of the cut. It was found, however, that the snow would melt from beneath the rods, and on the adjacent ground and roof of the shed, so that the entire mass, many feet deep, would hang upon the rods, bending them down and pulling the sheds in towards the bank, throwing them out of line in a direction opposite to that which occurred when there were no rods. This brought about a still further development, that of extending the roof, where it was practicable, into the adjacent banks, forming a shed which prevented the wedge of snow piling in between the building and the bank. Much shed of this character is still in use over the high Sierras.

This was found to be of such advantage that it suggested the present typical shape, which is that of a flat roof, making the top of the shed somewhat wider than the bottom, so that the melting wedge of snow, between the structure and bank, falls away from the side of the shed instead of pressing against it, and the weight upon the base is increased to prevent overturning. This form of roof necessarily brought the roof covering down closer to the locomotive stacks and increased the danger of fire during the dry summer season. To obviate this hazard, deflectors are attached to the smokestacks of the mountain locomotives for the purpose of throwing the sparks to the sides instead of straight up against the roof of the snow-sheds. These deflectors are so hung that they can be thrown to one side of the stacks when the engines are not in the sheds.

But there still remained the danger from brush and forest fires, which cause most of the trouble, although the right of way is kept clear of all brush and trees. On the Central Pacific there are 30 miles of continuous snow-sheds, and others in isolated spots bring the total up to about 33 miles, along the Sacramento and Truckee section. Travelers are well acquainted with the famous chain of snow-sheds over the Sierra Nevada range. The sheds are built right up to tunnel portals so that trains pass from shed into tunnel and out into shed again, over the 33 miles course, without going into the open. With the advent of the snow plow it was presumed that the sheds could be ultimately done away with, but near the summit of the Sierra Nevada mountains, the track is subject not only to blockade from snow but also from avalanches containing rocks, trees, etc., carried along with the sliding snow, against which the snow plow is of no avail. During long continued snow storms, only the snow plows could use the tracks to the exclusion of traffic, as the deep cuts would fill behind the plows almost immediately. Therefore it seems impracticable to dispense with the snow-sheds in this section of the country, in which the snow lies upon the ground in some years from November to June.

The stretch of track subject to these conditions lies about equally on each side of Summit station at the top of the Sierras, 7,017 ft. above sea level. Considering

this long stretch of shed, the danger of great loss and delay due to fires constitutes a continual menace to operation. To take care of this an elaborate system of watchmen has been devised, who are in communication with each other and with various intermediate points by telephone. There are seven of such watching or look-out stations, at which watchmen are stationed day and night, and from one of these stations—Red Mountain—several miles from the track and 2,000 ft. above it, nearly the entire line of sheds is visible. There are maintained at all times three fire trains, one at Blue Canyon, one at the Summit and one at Truckee, and a fourth, during the driest part of the summer at Cisco, making one fire train at each end of and two near the middle of the sheds. These fire trains are always ready, with steam up and crews at hand. Each consists of a locomotive, fire fighting brigade and water cars which, with the prompt notice received, can reach any point in the snow-sheds within a very few minutes and extinguish a fire with little difficulty; for instance, during the past summer, the total fire loss has been negligible—not over $100.

In spite of all precautions, however, a blaze will sometimes get under way and destroy some miles of shed before it can be checked. In such cases it has been found by the Southern Pacific that the only sure way to head it off is to tear down 50 to 100 ft. of the sheds, which prevents the remainder from acting as a chimney and drawing the flame along.

The recurrence of these fires, with heavy property loss and traffic delays, suggested the idea of supplying gaps at suitable intervals along the line of snow-sheds which can be closed up before the winter snow storms set in. This consideration brought out the design illustrated in the accompanying photographs and drawing. The gaps, or telescopic sheds, consist of either one or two sections, 50 ft. long, of movable shed run on wheels on a track having a gauge of 16 ft. 8 in., the rails being supported on sills outside the regular track ballast line of the main railroad track. These telescopic pieces are arranged to run inside a section at one or both ends of the gap, built larger for that purpose.

During the winter, the sections are closed, and extra braces are bolted on, so that the shed is then continuous and of practically the same construction throughout. As soon as the heavy storms are over and the snow has about ceased falling for the winter, the braces are removed and the telescopic shed is slid into the adjacent large section. A switch engine, a few men with block and tackle or a work train furnishes the power.

These movable or telescopic snow sheds are intended eventually to be placed at distances of from 2,000 ft. to a half mile apart, in places favorable to their location. They are not necessarily built upon tangents; in fact, several of them are upon curves, but the curvature of the track must be unchanged over the gap and within the enlarged section of the adjacent shed. The Southern Pacific now has in position some 16 telescopic sections, and so far they have proved successful in stopping the progress of any fire which has gotten beyond control and should be an efficient means of preventing the destruction of more than one section at a time.

## A New Type of Air Compressor.

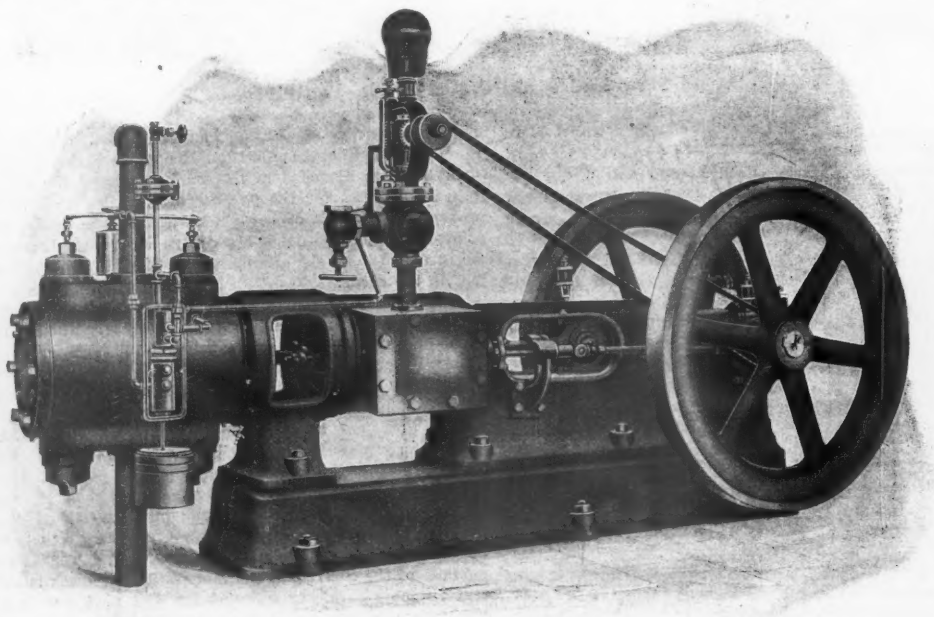
The Chicago Pneumatic Tool Company is making a new type of air compressor at its works at Franklin, Pa. It is designed to meet a demand for an efficient, simple and compact compressor at a moderate price. It is made in a variety of sizes and styles, either single, duplex or compound, and steam, belt, chain, or electric-motor driven. The smallest size has a capacity 30 cu. ft. of free air per minute. The frame of these machines is of box section, designed with a large factor of safety to withstand the stresses induced when running under maximum load. The cross-head guide is bored out and provision is made for catching and removing the drip from the bearings and stuffing boxes. Compressors having cylinders, 8 in. in diameter and larger are furnished with or without a sub-base. With the sub-base, the compressor is self-contained, is easy to erect and requires a less costly foundation.

The air cylinder and heads are completely water jacketed. The steam valves on cylinders under 12 in. in diameter are of the plain slide type. Cylinders larger in diameter than 12 in., have the Meyer gear with adjustable cut-off valves. The air valves are poppet valves, made from high grade steel, with removable seats and guides. They are easily renewed or repaired and are effectually prevented from entering the cylinder in case of breakage. They are placed radially in the cylinder and seat themselves accurately, thus reducing the wear to a minimum.

The pistons are solid, with cast-iron spring rings, accurately fitted; and the piston rods are of the best machinery steel. The shaft has heavy crank arms, is of ample diameter and is made of the best open-hearth steel. The cross-head is cast-iron and has adjustable shoes, top and bottom. Open-hearth steel is used for the connecting rod which has bronze cross-head pin boxes with wedge adjustment. The crank-pin end has a marine type box, lined with babbitt metal.

Each compressor has two fly wheels, keyed to the shaft and of sufficient weight to insure smooth operation. An unloading device is provided to relieve the machine of all load when the desired air pressure is obtained and to automatically cause it to resume delivery when the storage pressure becomes reduced. In addition a pressure-regulating governor, working in connection with a speed governor on the steam end, controls the speed and output of air of the machine in accordance with the demands made on it. Provision for indicator connections is made on both the steam and air cylinders.

Each compressor is subjected to a working test before shipment. Although designed primarily to supply air for pneumatic tools in railroad and machine shops, foundries, ship yards, and stone yards, they are equally suitable for actuating rock drills, coal cutters and other machinery in mines, tunnels, and quarries, for pumping water by the air-lift system and for similar purposes.



New Type of Air Compressor of the Chicago Pneumatic Tool Company.

## Progress in the Use of the Block System.

On the opposite page is a table bringing up to the present year the data concerning the use of the Block System for spacing trains which has been given in the *Railroad Gazette* in past years (Feb. 27, 1903; Jan. 11, 1901; etc.). The totals of the several columns may be summarized as follows (miles of road):

| | | |
|---|---|---|
| Automatic— | | |
| Single track | 964.6 | |
| Double track | 3125.7 | |
| Four track | 301.0 | |
| | | 4391.3 |
| Manual— | | |
| Single track | 28508.2 | |
| Double track | 5796.3 | |
| Four track | 702.6 | |
| | | 35007.1 |
| Automatic and manual, total | | 39398.4 |
| Deduct three-track lines entered twice | 116.5 | |
| Deduct joint lines included twice | 18.0 | |
| | | 134.5 |
| Total on which block signals are used | | 39263.9 |
| Deduct lines on which block signals are used partially or only for pass. trains, namely: | | |
| Buffalo, Rochester & Pittsburg | 363.0 | |
| Chicago & Alton | 518.8 | |
| Chicago, Milwaukee & St. Paul | 4301.3 | |
| Delaware, Lackawanna & Western | 699.1 | |
| Grand Trunk | 197.9 | |
| Michigan Central | 180.0 | |
| Norfolk & Western | 180.4 | |
| Rio Grande Western | 7.0 | |
| Southern | 5935.0 | |
| | | 12382.5 |
| Net mileage of road worked wholly by the block system | | 26881.4 |

Some comparisons with the totals of one year ago will be found in the editorial column.

### NOTES ON THE TABLE.

Atchison, Topeka & Santa Fe.—Of the manual block signaling on single track, about 41 miles is controlled manual, being worked by the electric train staff.

Baltimore & Ohio.—The item representing proposed new work is the same as that reported last year. No definite date has yet been set for carrying out the improvements.

Boston & Albany.—Of the 137.9 miles double track 51.4 miles represents sections, mostly short, where in many cases the eastbound track is signaled but the westbound is not, or vice versa. The total mileage reported by this company appears to indicate that there was an error in last year's figures.

Buffalo, Rochester & Pittsburg.—On this road the block signals are used ordinarily for the protection of passenger trains, but in thick weather freight trains also are run by the block system

Central of Georgia.—In this item is included six miles of line used jointly with the Atlanta & West Point, and six jointly with the Southern Railway.

Central of New Jersey.—Only a part of the new work proposed a year ago has yet been carried out.

Chesapeake & Ohio.—Of the single track mileage on the Chesapeake & Ohio, 256 miles is manual controlled, and seven miles is manual controlled by means of the electric train staff.

Chicago, Burlington & Quincy.—Of the proposed new signaling, which is to be manual, 300 miles is for single track lines and 270 miles for double track.

Chicago, Milwaukee & St. Paul.—The two items set against this road, aggregating 6,848 miles, represent the whole of the lines of that company. On the mileage shown in the second item, passenger trains are block signaled at all times, but freight trains are spaced by the time interval when it is not convenient to enforce the block system.

Cincinnati, New Orleans & Texas Pacific.—A small part of the 306 miles single track is worked by the electric staff, and not by automatic signals.

Delaware, Lackawanna & Western.—On the 699.1 miles where manual signals are used the block system is ordinarily employed only to protect passenger trains.

Erie.—Forty-four miles, including the four-track portion, is worked by controlled manual signals.

Erie.—In the table published last year, the New York, Susquehanna & Western mileage was included in the Erie. The difference between the present and the former figures is accounted for partly by this and partly by the correction of an error.

Grand Trunk.—Block signaling on the lines of this company is employed for the protection of passenger trains only. This method is in force on all of the lines of the Grand Trunk east of the Detroit River; that is to say, all of the mileage in Canada and that in the table, which represents the lines in Maine and New Hampshire.

Illinois Central.—The six-track and eight-track lines are so entered as to make the total too large; the actual length of line represented is 151 miles.

Michigan Central.—On the 180 miles signaled with manual signals the block system is used ordinarily to protect the rear of passenger trains only.

New York Central & Hudson River.—The proposed new signaling is for 96 miles of single track and five miles, double track, manual signaling; and five miles, double track, automatic signals.

New York, New Haven & Hartford.—Of the manual block signals on the double track and on the four-track road of this company, 229 miles is controlled manual. Of the proposed new work, 20 miles represents automatic signals, double track, and 11½ miles represents manual signals, part double track and part four-track.

Norfolk & Western.—The proposed new mileage represents automatic signals for the Radford division.

Pennsylvania.—The 18 miles of proposed new work represents automatic signals for four-track lines, presumably to take the place of manual signals.

Pennsylvania Lines West of Pittsburg.—The proposed new work is the same as that shown in the table of last year. The apparatus and equipment has been partly made ready, but none is yet in use.

Pittsburg & Lake Erie.—The proposed new work is automatic signaling for double track lines, to supersede manual block signals.

Pere Marquette.—The proposed new work is automatic signaling for single track lines.

Rio Grande Western.—The block signals are used only for the protection of passenger trains, at the rear, moving in one direction only.

Southern Pacific.—Of the new work proposed, 97 miles will be single track, automatic, and 24 miles double track, automatic. The new signals in Texas are to be automatic, on single track.

Southern Railway.—On the 5,935 miles represented in the second item, the block systems are used for the protection of the rear of passenger trains only.

Wabash.—Of the proposed new work, which is all manual signaling, 404 miles will be single track and 10 miles double track.

MILES OF RAILROAD WORKED BY THE BLOCK SYSTEM. JANUARY 1, 1904.

| | Automatic. | | | Manual. | | | | |
|---|---|---|---|---|---|---|---|---|
| | Single track. | Double track. | Four track. | Single track. | Double track. | Four track. | Total. | Proposed. |
| Atchison, Topeka & Santa Fe | 11.0 | 25.0 | .... | 960.8 | 68.0 | .... | 1064.8 | .... |
| Atlanta & West Point—jointly with Central of Georgia | .... | .... | .... | .... | 6.0 | .... | 6.0 | .... |
| Atlantic City | .... | 55.0 | .... | 38.2 | .... | .... | 93.2 | .... |
| Atlantic Coast Line | .... | .... | .... | 302.0 | .... | .... | 302.0 | 30 |
| Baltimore & Ohio | 2.5 | 96.6 | .... | 131.8 | 516.1 | 1.5 | 748.5 | 200 |
| Baltimore & Ohio Southwestern | .... | .... | .... | .... | 27.8 | 2.8 | 30.6 | .... |
| Bessemer & Lake Erie | .... | .... | .... | 153.7 | 37.9 | 191.6 | 383.2 | .... |
| Boston & Albany | .... | 137.9 | 16.0 | .... | .... | .... | 153.9 | some |
| Boston & Maine | 2.5 | 101.5 | 2.2 | .... | 111.7 | .... | 217.9 | .... |
| Buffalo, Rochester & Pittsburg | .... | .... | .... | 363.0 | .... | .... | 363.0 | .... |
| Central of Georgia | .... | .... | .... | 64.0 | .... | .... | 64.0 | .... |
| Central of New Jersey | .... | 138.4 | 32.0 | .... | .... | .... | 170.4 | 50 |
| Chesapeake & Ohio | .... | .... | .... | 870.9 | 154.4 | .... | 1025.3 | .... |
| Chicago & Alton | 272.0 | 44.7 | .... | 518.8 | 81.8 | .... | 917.3 | .... |
| Chicago, Burlington & Quincy | .... | 4.0 | 6.0 | 200.0 | 200.0 | .... | 410.0 | 570 |
| Chicago & Eastern Illinois | 8.0 | .... | .... | 604.0 | 113.0 | .... | 725.0 | .... |
| Chicago Great Western | .... | .... | .... | 190.0 | 4.0 | .... | 194.0 | 580 |
| Chicago, Milwaukee & St. Paul | 9.0 | 24.5 | .... | 2157.5 | 355.7 | .... | 2546.7 | .... |
| Chic., Milwaukee & St. P. for passenger trains and part of time for freights | .... | .... | .... | 4301.3 | .... | .... | 4301.3 | .... |
| Chicago & North Western | .... | 254.7 | .... | 1082.2 | 491.8 | .... | 1828.7 | .... |
| Chicago Terminal Transfer R. R. | 0.6 | 5.0 | .... | .... | .... | .... | 5.6 | .... |
| Chicago, Rock Island & Pacific | .... | 15.0 | .... | 1521.0 | .... | .... | 1536.0 | .... |
| Chicago & Western Indiana | .... | .... | .... | .... | 19.8 | .... | 19.8 | .... |
| Chicago, St. Paul, Minneapolis & Omaha | 3.5 | 1.1 | .... | 442.6 | 20.0 | .... | 467.2 | .... |
| Cincinnati, Hamilton & Dayton | .... | .... | .... | .... | 25.0 | .... | 25.0 | .... |
| Cincinnati, New Orleans & Texas Pacific | 306.0 | 2.5 | .... | .... | .... | .... | 308.5 | 18 |
| Cleveland, Cincinnati, Chicago & St. Louis | .... | .... | .... | 670.0 | 124.0 | .... | 794.0 | 44 |
| Delaware & Hudson | 5.3 | 33.2 | .... | .... | .... | .... | 38.5 | .... |
| Delaware, Lackawanna & Western | 2.5 | 242.1 | .... | 699.1 | .... | .... | 943.7 | .... |
| Delaware, Lackawanna & Western—three track—equal to | 4.1 | 4.1 | .... | .... | .... | .... | 4.1 | .... |
| Erie | .... | .... | .... | 823.1 | 572.2 | 12.0 | 1407.3 | .... |
| Erie & Wyoming Valley | .... | .... | .... | .... | .... | .... | .... | .... |
| Grand Trunk (Portland Line) | .... | .... | .... | 197.9 | .... | .... | 197.9 | .... |
| Hannibal & St. Joseph | .... | .... | .... | 6.0 | .... | .... | 6.0 | .... |
| Illinois Central | 6.0 | 130.0 | .... | .... | .... | .... | 136.0 | .... |
| Illinois Central, four-track (6), six-track (4), and eight-track (4)—equal to | .... | .... | 20.0 | .... | .... | .... | 20.0 | .... |
| Kentucky & Indiana Bridge & Railroad Co | .... | .... | .... | 7.4 | 2.0 | .... | 9.4 | .... |
| Lake Shore & Michigan Southern | .... | 86.0 | 9.5 | 885.8 | 418.8 | 10.4 | 1410.5 | .... |
| Lake Shore & Michigan Southern, three-track, equal to | .... | .... | .... | 40.7 | 40.7 | .... | 40.7 | .... |
| Lehigh Valley | 40.0 | 426.9 | .... | 597.9 | 69.6 | .... | 1134.4 | 20 |
| Lehigh Valley, third track | 2.5 | 2.5 | .... | .... | .... | .... | 2.5 | .... |
| Long Island | .... | 39.5 | .... | 6.5 | 32.5 | .... | 78.5 | .... |
| Los Angeles Terminal | .... | 2.0 | .... | .... | .... | .... | 2.0 | .... |
| Michigan Central | 20.0 | 333.0 | .... | .... | 180.0 | .... | 533.0 | .... |
| Mobile & Ohio | .... | .... | .... | 20.0 | .... | .... | 20.0 | .... |
| Nashville, Chattanooga & St. Louis | .... | .... | .... | 37.0 | 5.6 | .... | 42.6 | .... |
| New York Central & Hudson River | .... | 80.7 | 12.5 | 1527.9 | 352.6 | .... | 1973.7 | 106 |
| New York Central & Hudson River, controlled manual | .... | .... | .... | .... | 156.2 | 299.9 | 456.1 | .... |
| New York, New Haven & Hartford | 25.0 | 214.5 | .... | 195.8 | 170.7 | 68.8 | 674.8 | 31 |
| New York, Ontario & Western | 62.0 | 12.0 | .... | .... | .... | .... | 74.0 | 12 |
| New York, Susquehanna & Western | .... | .... | .... | 1.4 | 22.2 | .... | 23.6 | .... |
| New York & Long Branch | .... | 37.0 | .... | .... | .... | .... | 37.0 | .... |
| Norfolk & Western | 2.9 | .... | .... | 1038.6 | 116.7 | .... | 1158.2 | 70 |
| Norfolk & Western, for passenger trains only | .... | .... | .... | 180.4 | .... | .... | 180.4 | .... |
| Northern Central (included in P. R. R.) | .... | .... | .... | .... | .... | .... | .... | .... |
| Northern Pacific | .... | .... | .... | 328.0 | .... | .... | 328.0 | .... |
| Ohio River Bridge | .... | .... | .... | 1.5 | 3.2 | .... | 4.7 | .... |
| Oregon Short Line | 23.0 | .... | .... | .... | .... | .... | 23.0 | .... |
| Pennsylvania | 4.2 | 77.2 | 159.4 | 175.2 | 550.6 | 112.6 | 1079.2 | 18 |
| Pennsylvania, three-track line, equal to | 3.0 | 3.0 | .... | 53.9 | 53.9 | .... | 56.9 | .... |
| Pennsylvania Lines West of Pittsburg | 2.0 | 10.0 | 24.0 | .... | 398.0 | 3.0 | 437.0 | 548 |
| Peoria & Pekin Union | .... | 1.0 | .... | .... | 5.4 | .... | 6.4 | .... |
| Pere Marquette | 9.5 | .... | .... | .... | .... | .... | 9.5 | 50 |
| Philadelphia & Reading | 20.2 | 282.6 | 2.7 | 103.8 | 116.0 | .... | 525.3 | .... |
| Philadelphia & Reading, three-track line, equal to | 12.3 | 12.3 | .... | .... | .... | .... | 12.3 | .... |
| Philadelphia, Baltimore & Washington (included in P. R. R.) | .... | .... | .... | .... | .... | .... | .... | .... |
| Pittsburg & Lake Erie | .... | 96.5 | 16.2 | 30.5 | 23.6 | .... | 166.8 | 24 |
| Richmond, Fredericksburg & Potomac (including Washington Southern) | .... | .... | .... | 75.2 | 38.8 | .... | 114.0 | .... |
| Rio Grande Western | .... | .... | .... | 7.0 | .... | .... | 7.0 | .... |
| South Side Elevated, Chicago | .... | 8.7 | .... | .... | .... | .... | 8.7 | .... |
| Southern Railway | .... | 2.0 | .... | 97.0 | 32.0 | .... | 131.0 | .... |
| Southern Railway, passenger trains only | .... | .... | .... | 5935.0 | .... | .... | 5935.0 | .... |
| Southern Pacific | 90.0 | 11.2 | 0.5 | 172.0 | 26.0 | .... | 299.7 | 121 |
| Southern Pacific, Texas lines | .... | .... | .... | .... | .... | .... | .... | 55 |
| St. Louis, Keokuk & Northwestern | .... | 16.0 | .... | .... | .... | .... | 16.0 | .... |
| St. Louis & San Francisco | 2.0 | 4.0 | .... | 81.0 | 17.0 | .... | 104.0 | .... |
| Terminal Railroad Association of St. Louis | .... | .... | .... | .... | 12.0 | .... | 12.0 | .... |
| Staten Island Rapid Transit | .... | 8.7 | .... | .... | .... | .... | 8.7 | .... |
| Union Pacific | 13.0 | 43.1 | .... | .... | .... | .... | 56.1 | .... |
| Wabash Railroad | .... | .... | .... | 604.7 | 23.0 | .... | 627.7 | 414 |
| West Jersey & Seashore (included in P. R. R.) | .... | .... | .... | .... | .... | .... | .... | .... |
| Wisconsin Central | .... | .... | .... | 6.1 | .... | .... | 6.1 | .... |
| Total | 964.6 | 3125.7 | 301.0 | 28508.2 | 5796.3 | 702.6 | 39281.9 | 2961 |

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

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The report of the Massachusetts Railroad Commission, which is reviewed elsewhere in this issue, shows that the total capitalization of the electric railroads within the State is at the rate of $48,621 per mile of line. Massachusetts is the only State in the Union which makes any real effort to restrict the capitalization of these properties to a sum representing their "fair replacement value," as it is expressed by the commission; it is also a densely populated State, with a large electric mileage in city streets, where it is expensive to lay track. Yet the average capitalization of all the electric railroads in the country, according to the census report for the year ending June 30, 1902, is no less than $128,881 a mile. The electric railroads have found a new field, in the last six or seven years of great extension. Mistakes and unsound methods have been covered up by constant traffic gains, and it is not surprising that financial inflation should have accompanied the increases in mileage. But the comparison of the Massachusetts figures with the census figures would indicate that fully half of the capitalization of the electric roads of the country at large, standing at a sum more than twice as great per mile as the total capitalization of the steam roads, represents nothing other than promoters' profits. The electric roads, as a class, have been taking their maintenance charges much less seriously than the steam roads, and it is to be feared that the time is not far distant when, with greatly impaired credit, they will be called upon to make extensive simultaneous renewals. Net earnings have been left as large as possible, for dividend purposes, and expenses, with new roadbed and equipment, have been small. Some roads, such as the Albany & Hudson, have already found it impossible to make more than their fixed charges, and there is every indication that startling traffic gains and unusually careful management will be needed, during the next four or five years, to protect a large number of interurban properties from the necessity of getting new capital at a time when it will be exceedingly hard to find.

The block system is now in use on over 39,000 miles of railroad in the United States, which is about 9,500 miles more than appeared in the statistics gathered one year ago (*Railroad Gazette*, Feb. 27, 1903, page 146). The statement does not necessarily mean that every train in this 39,263.9 miles is protected by the space interval. In this country, as in England, the only facts that can be statistically recorded are those concerning the facilities provided; what is actually done with the facilities may vary. If one passenger train each way, daily, is protected from being struck by following trains by a rule requiring each station agent to hold such following train until he knows that the passenger train has passed a certain distance beyond, the block system is in use; and there is nothing to hinder its use for all trains. The length of road on which all passenger trains are now blocked, and on which freight trains are blocked with few exceptions, is 26,881.4 miles, this figure being obtained by making the deductions, amounting to 12,382.5 miles, which are set forth in connection with the table, which is printed on another page. This smaller total of 26,881.4 miles is 4,099.7 miles more than the corresponding total of one year ago. On this mileage the block system, though lacking important adjuncts, affords a degree of protection. It is nearly 13 per cent. of the total railroad mileage of the country and may be considered a respectable beginning. The Chicago Great Western, the Buffalo, Rochester & Pittsburg and the Grand Trunk appear in the table for the first time. On all railroads or parts of railroads where the traffic comes anywhere near taxing the capacity of the line, the only adequate block signaling is the automatic, controlled by track circuit, for only with this can the block sections be economically made as short as is desirable. The first three columns of our table are, therefore, of particular interest. The total of these, 4,391.3 miles, is almost exactly 500 miles larger than the corresponding figure of a year ago, an increase of nearly 13 per cent. Not all of the new work proposed a year ago has been carried out, but some new signals have been put in which were not mentioned at that time; and the proposed work which has not been done still appears in the "proposed" column.

### The Competition of the Interurban Roads.

During the past two years, the *Railroad Gazette* has printed detailed studies of the competitive conditions existing in eight or ten localities where the development of interurban electric roads is most typical and complete. The last of these articles, dealing with the Indianapolis group of roads, appeared in the issues of January 8 and 15. The investigation has shown that the nature and effects of the competition are not always the same, but the field examined has been sufficiently broad so that it is believed that a series of general principles can be formulated which will cover all the types of competition which now exist.

In comment on the conditions in northern New York State, where electric competition with the steam roads is active and general, a distinction was drawn between the effect of parallel electric roads on main and on branch lines. It seems to be true there, and elsewhere, that an interurban road paralleling the main line of a steam railroad does fully as much good as it does harm, by specifically acting as a collector of through traffic, and marshalling it at certain points, as well as by performing general services in building up the territory, and in starting people traveling. The function of electric roads in fostering the "traveling habit" is perhaps not fully appreciated. The ease with which a journey of twenty-five or thirty miles can be undertaken, without much forethought or preparation, on an interurban car which, running at frequent intervals, passes directly by the residence or office, has undoubtedly lessened what may be called the minimum amount of urgency necessary to start the public traveling, and the habit once formed is tenacious and readily extends to the longer hauls which are the natural province of the steam road. An officer of a well-known eastern road, who does not wish to be quoted, says that although the electric roads take away about sixty-five per cent. of the local short haul traffic almost as soon as they are opened, the business all comes back in a year or so in the form of new through business, marshalled at the cities and larger towns, and more profitable than the traffic lost. The road in question makes no effort to meet the main line competition of the electric roads, as such efforts in the past have been not only futile and expensive, but seemingly unnecessary, for the best interests of the steam railroad.

Branch line competition, however, is a different matter. The value of the passenger traffic of a branch line depends, in general, either on local short haul business, which the electric road will surely take away from it, or upon its service as feeder to the main line, and if the interurban road also assumes the duty of main line feeder, the economic services of the branch are much diminished. The Rochester & Sodus Bay road, running along the shore of Lake Ontario east from Rochester, parallel to the Rome, Watertown & Ogdensburg branch of the New York Central, is a good example of a branch line competitor. With rates higher, both single and round trip, than those put into effect on the steam road to meet its competition, it has reduced by about a third the short haul passenger business of the R. W. & O. through the 40 mile competitive radius, while it has created for itself a traffic out of all proportion to that which formerly existed. The steam road runs from half to three-quarters of a mile from the centers of the towns along the route, while the electric cars go down the main street, and have baggage compartments which enable them to deliver trunks at the doors of local hotels, saving the traveler the cost of transfer.

The peculiar franchise advantages by which interurban roads can obtain the greater part of their right of way at insignificant cost, maintain a service almost at railroad speed in the country, and then send their cars down the main streets of the cities and towns, gives them a handicap in securing short-haul traffic with which it is not possible to compete. The limitation comes, of course, in cities so large that the time lost by the car in threading its way through the streets at grade deprives it of its utility as a means of rapid transit. The Illinois Central reports that its suburban service on private right of way out of Chicago does not feel the street car competition; similarly, it would be quite futile for the Bronxville roads to pick up their passengers in downtown New York. But in cities the size of Detroit, of Indianapolis or of Cleveland, where the time lost in the congested streets cannot be avoided, owing to the absence of rapid transit facilities above or below grade, the "commuter" and other suburban business of the steam roads has been almost wholly taken away. The following tables of short haul passenger traffic in the Cleveland district before the completion of the electric interurban lines and in 1902, are reprinted from our issue of Feb. 6, 1903.

*Lake Shore & Michigan Southern—Passengers Carried Between Cleveland and Oberlin and Intermediate Points.*

| | Westbound. | Eastbound. | Total. | Average per month. |
|---|---|---|---|---|
| 1895..... | 104,426 | 98,588 | 203,014 | 16,918 |
| 1902..... | 46,328 | 45,433 | 91,761 | 7,647 |

*Passengers Carried Between Cleveland and Painesville and Intermediate Points.*

| | Westbound. | Eastbound. | Total. | Average per month. |
|---|---|---|---|---|
| 1895..... | 97,460 | 101,832 | 199,292 | 16,608 |
| 1902..... | 13,106 | 15,602 | 28,708 | 2,392 |

*New York, Chicago & St. Louis—Passengers Carried Between Cleveland and Lorain.*

| | Total passengers. | Revenue. | Average revenue. |
|---|---|---|---|
| 1895..... | 42,526 | $25,523 | 60c. |
| 1902..... | 9,795 | 4,379 | 44c. |

Oberlin is 34 miles from Cleveland, Painesville is 29, and Lorain, 26. It is to be regretted that the electric roads do not keep statistics which would enable their gains to be set off against the losses of the steam roads; the Cleveland, Lorain & Wheeling did so for a time, but abandoned the practice because it involved too much clerical work. This line competes with the Lake Shore & Michigan Southern for the business to Oberlin and intermediate points, but also goes beyond Oberlin, so that no exact comparison is possible. Approximately three million passengers were carried in 1902, however, as against less than 100,000 by the steam road in a territory slightly smaller.

What proportion of these great increases in business are due to the slightly lower fares and what proportion to increased convenience is of course impossible to determine. Two examples may be given, off-hand, of interurban lines which keep a lion's share of the traffic, and have built up important increases, without attempting to meet competitive cuts made by the steam roads. These are the Rochester & Sodus Bay, previously mentioned, and the Syracuse, Lakeside & Baldwinsville, which parallels the Oswego line of the Lackawanna. In the latter case, the steam road is locally unpopular because of its suppression of a previous competitor by a cut followed by a restoration of rates after the competition ceased, and this presumably has some influence on the traffic. But, generally speaking, hourly or half-hourly cars passing through the city streets are probably a greater inducement than a slight difference in rates, so far as the majority of the traffic is concerned.

An extraordinary development of business, a creation of traffic seemingly out of nothing, has grown up on all the prosperous interurban roads, as in the case of the Cleveland lines, quoted above. Between Detroit and Ann Arbor, 40 miles, the strictly local passenger business of the Michigan Central was estimated as averaging somewhere between 200 and 300 passengers a day. The Detroit, Ypsilanti, Ann Arbor & Jackson electric road has been carrying from 2,000 to 4,000 passengers a day in the same territory, ever since it was opened. A difference as great as this cannot be attributed solely to the fact that the rate is considerably lower on the electric line; the Michigan Central has made no effort to meet the passenger rates of the electric road, which average about a

cent a mile, in the cheapest form, but if it did so, it is not to be supposed that it could multiply the figures of its former business by 10, 15 or 20. The gains must, ultimately, be traced back to frequency and convenience of service and the "traveling habit," reverting to the principle of a lesser minimum of urgency, mentioned above.

The freight and express business of the electric roads has in some cases been developed to considerable importance, while in other cases it has been neglected entirely. At Albany, Cleveland, and elsewhere a large traffic of express and light freight is carried; at Rochester, the Rochester & Sodus Bay road carries bulky freight also, in trains of five or six box or flat cars. At Detroit, the Detroit, Ypsilanti, Ann Arbor & Jackson competes aggressively with the Michigan Central for package traffic, while the Detroit United lines, aggregating over 300 miles, exclusive of city lines not forming portions of the through routes, are not interested in express traffic, and do a small business only. The best opinion in the matter seems to be that an electric road is foolish to meddle with bulky freight, but that package and express traffic may be made very profitable. While it may be said with steam railroads, that local short-haul passenger business becomes unprofitable as soon as it begins to seriously interfere with freight schedules, it is even more true with electric roads that there is no profit in freight business which restricts the passenger service as the haulage of bulky freight on busy electric lines must do. Package freight is quite another matter, and the interurban roads have a useful and profitable field of their own in the collection and delivery of goods for rural dwellers at any desired point along the line.

The lesson for steam railroads which stands out clear and distinct from a study of present interurban conditions is that there is no profit in competing with electric roads which parallel the main line, except in special, isolated cases. The railroad manager who attempts to put an interurban road out of business by competing with its rates and frequency of service is in the position of the worthy citizen who was kept awake on a winter night by the howling of his neighbor's dog, and announced his intention of taking the dog to the street corner and holding it there until it froze to death. Railroads doing an important local or branch line business will probably find that their best recourse lies in control, or partial control, of the competitive territory, following in general the policy of the New York, New Haven & Hartford. In England, where local passenger traffic supplies a much larger proportion of gross earnings than in this country, extensive experiments are being tried with the electrification of the competitive portions of several railroads, but it is too soon, as yet, to form an opinion as to the way this is going to work out. An electrified road with private right of way and no street franchises gains the advantage of being able to conduct its transportation economically in small units, but still lacks the tremendous terminal privileges of the street car. Control of the interurban lines in the immediate territory traversed by the steam railroads seems in many ways the best solution of the problem, and lines so controlled should in most cases be able to protect the railroad from indiscriminate competition, bring it new through business, and pay their own way while doing so.

## Report of Massachusetts Railroad Commissioners.

The Massachusetts Commission report for the year ending June 30, 1903, covers returns from 47 railroad corporations, of which 10 only are operating companies, and three of these, the Boston & Albany (New York Central & Hudson River, lessee), the Boston & Maine and the New York, New Haven & Hartford, have operated over 96 per cent. of the mileage and conducted nearly 98 per cent. of the entire passenger and freight business. In investigating the hours of employment advisable for railroad employees the Commission has given hearings and asked information alike from employers and from the various classes of employees, but is convinced that a large majority of railroad employees do not desire legislation to fix hours of labor upon railroads, and that any attempt at this time to regulate the matter by statute would be productive of more evil than good. The desirability of legislation in regard to guard rails on freight cars was also considered, but no advocates urged it, and the Commission believes that a measure of protection of this kind should have a broader foundation than a statute of the State.

Gross assets of the steam railroads increased from $418,298,274 to $432,780,849 in 1903; and the total length of main and branch line mileage in the State, exclusive of second track and sidings, increased 4½ miles. Gross liabilities increased from $383,106,669 to $394,277,139. A table of gross assets, liabilities and surplus for the last ten years shows that at present this percentage is 16.33, as againt 16.70 in 1902 and 16.32 in 1901. In 1894 the percentage was 5.89. Dividends aggregating $13,495,189, or 5.97 per cent. of the total capital stock, were declared during the year as against dividends aggregating $13,201,264, or 6.26 per cent. in 1902. Five companies paid 10 per cent., two paid 9 per cent., one 8¾, four 8 per cent. and others, to a total of 32 of the 44 corporations, declared dividends ranging from this amount to 1 per cent. Twelve corporations paid no dividends.

The total mileage run by passenger trains was 30,925,409, an increase of 1,274,122 miles over the previous year; by freight trains, 18,523,087, an increase of 1,261,292 miles. The total number of passengers carried was 123,162,793, an increase of 7,516,896 passengers over the previous year. Each passenger traveled on the average 17.16 miles, a slightly longer journey than ever before recorded; and the average number of passengers per train mile was 68 as against 67 last year.

During the year, one passenger was killed by causes beyond his control, and 31 were injured by causes beyond their control; the number of passengers killed through their own fault, or want of care, was 6; and of those similarly injured, 18. This makes a ratio of one passenger killed without contributory negligence for every 98,530,234 carried, and one person similarly injured for every 54,525,806 passengers carried. The total number of persons killed at grade crossings was 26, which is exactly the same as the average number for the last 10 years; 12 were injured as comparing with an average of 32.

Statistics of the street railroad companies are also given with full detail. Annual returns for the year ending Sept. 30, 1903, have been received from 109 street railroad companies. Eight companies were organized during the year under the general law and added to the list and five companies were dropped from the list, three having been consolidated during the previous year and two succeeded by new corporations following receivers' sale. Forty-eight miles of new street railroads were added during the year, making a total mileage of 2,621 in the State as against a steam railroad mileage of 2,111. It is a curious feature of the general law that a street railroad in Massachusetts to obtain its charter and franchise privileges must be built entirely upon highways, except in certain specific cases where it is necessary to avoid grades, curves and grade crossings. In passing upon several cases which have recently arisen the Board has ruled that where no heavy grades, sharp curves or other physical conditions make the highway unfit for use by a railroad, and where the only purpose in departing from it for long distances is to obtain a more direct route and an opportunity for higher speed, it cannot properly approve construction on private right of way. The Commission urges general legislation to permit interurban railroads to be built on private right of way on the grounds that a more direct route may thereby be secured, as there is less interference with the uses of the highway and higher speed is made possible.

The total capital stock of the electric roads Sept. 30, 1903, was $68,404,480, an increase of $8,368,152 from the previous year, and the total funded debt was $41,411,500, an increase of $3,660,500. Surplus increased from $2,147,494 in 1902 to $4,129,820 in 1903. The total amount of dividend declared was $3,586,248, an increase of $447,537. Forty-four out of the 109 companies paid dividends ranging from 1 to 10 per cent. and 68 companies declared, or paid, no dividends. The majority of the dividend payers paid 6 per cent. or better, and the percentage of dividends declared to total capital stock was 5.24 per cent. as against 5.23 per cent. last year. It is interesting to note the similarity of this average to the 5.97 percentage of the steam roads, owing to the care the Commission has always taken to guard against overcapitalization. Further comment on this point will be found in another column.

The average cost of the street railroads of the State per mile of main track (including the cost but not the length of side track) stood on the books of the companies Sept. 30, 1903, at $26,014 for construction, $9,994 for equipment, and $12,546 for lands, power plants and buildings and other permanent property, making a total average cost of $48,555 per mile of main track. The total capital investment per mile outstanding is $48,621. The electric companies earned $27,027,651 during the year, an increase of over $2,000,000; their total expenses prior to dividends were $23,424,735. The total number of miles run by street cars was 107,506,812, an increase of 7,226,125 miles over the previous year, and nearly three times the total car mileage ten years ago. The percentage of operating expenses to gross earnings for the current year was 68.59 comparing with 72.62 on the steam roads.

A Bureau of Economies, statistical and advisory, to enable operating officers to know how to decrease costs of operation is proposed by Mr. W. B. Waggoner in a paper read before the Western Railway Club. That such a bureau, organized and conducted in the manner outlined, could be made worth its cost to the railroad is strongly set forth in his paper. Railroad operating expenses are, roughly, two-thirds of the gross earnings, so that one per cent. saved increases the net earnings by two per cent. The extent to which railroad companies may profitably do manufacturing has in times past received its share of discussion, and it is rarely proved, it is more often guessed, whether or not they can manufacture as cheaply as industrial concerns. There are, however, some articles which it is to the advantage of a railroad company to make, rather than buy, and this without strict regard to cost. The number of such articles for a particular road is governed to a large extent by conditions peculiar to that road. But it is true that it is not often accurately known just what these articles cost the company. And as it would, in most cases, be a matter of some complication and of added expense to determine such costs accurately, railroad companies might properly feel that the requirements of the situation do not justify more than the approximation they usually use. But if substitutions of new methods and men, new tools and machinery, etc., are to be made wherever justified in the interests of economy, which is a healthy sort of retrenchment to be practiced by all roads at all times, the more accurate the knowledge possessed regarding not only costs of complete operations, but of any part of an operation, the more effective and systematic will be the retrenchment sought. Co-operation, as the paper suggests, is the condition primary to the success of efforts of this sort. With a bureau of the kind described there should not only be co-operation between the bureau and department heads; often the most valuable suggestions come from the workmen themselves, and it would be an object of the bureau to encourage such suggestions in a way that would cause the employees of all departments to keep constantly on the alert to discover new methods productive of greater economy.

## TRADE CATALOGUES.

*The 1904 catalogue of The Washburn Company*, Minneapolis, Minn., is a 76-page pamphlet fully illustrating and describing the different types and forms of couplers made by that company. The Washburn coupler has been on the market for seven years and the constant effort has been to improve the strength and economy of the design, without affecting its simplicity. Special attention is called to a new plan for re-inforcing the neck or shank of the coupler, with the object of eliminating all possibility of the head breaking off. Another feature peculiar to the Washburn is the hexagon head or "economy lug" for the pivot pin. Some very favorable records of guard-arm tests are presented. Detail drawings of freight couplers are given, also detail drawings of flexible-head passenger couplers, special Washburn types of uncoupling attachments, flexible-head and slide carriers, and of pilot and tender couplers, including the new design, the compound coupler. Drawings are also shown of the Washburn expansible draft box.

*Power & Mining Machinery Co.*, New York, has issued a new handsome edition of its engine catalogue in which a few of the more important features of the Crossley gas engine are briefly enumerated. This type of engine has met with great success in England and the Power & Mining Machinery Co. has acquired all the builders' rights for this continent and are building them in all sizes up to 650 h.p. in its own shops. In connection with an installation of Loomis-Pettibone gas producers, which the company also makes, these engines show a fuel economy almost twice as great as the best compound condensing steam plant.

*The Golden State* is a delightful little book prepared by the passenger department of the Rock Island. A Gratuitous Guide is the sub-title, and in it are suggestions, information, advice, history and descriptions relating to the sights, scenes and cities of "the Golden State." Fine half-tone engravings embellish the pages and there are also a number of full-page engravings in colors which add much to the attractiveness of the book. The contents are divided into eight chapters, in the last of which are given itineraries of trips of different lengths which are designed to enable travelers to utilize their time to the best advantage.

*Hammacher, Schlemmer & Co.*, New York, dealers in all kinds of cabinet, builders' and piano hardware, tools and general factory supplies, has published a small circular, No. 218, showing a few new designs of bail pulls and desk knobs. These goods have a fine finish and are made with superior workmanship throughout. Catalogue No. 192 of Fancy Cabinet Trimmings shows a full line of drawer pulls, escutcheons, knobs, ornaments, etc. Copies of either publication will be sent on request.

*A Compound Engine Test* is the title of a small 30-page catalogue issued by the Buffalo Forge Company. The book contains a report by Prof. R. C. Carpenter, of Cornell, on tests made on a Buffalo 12 in. and 18 in. x 10 in. compound condensing engine. Under most favorable load the steam consumption was 22.32 lbs. per indicated horse power per hour and the mechanical efficiency was 93 per cent.

## Railway Signal Association—Chicago Meeting.

The meeting of this Association which was held in New York on January 12, was reported, in the *Railroad Gazette* of last week. At the meeting in Chicago on the same day, Mr. J. C. Mock, President of the Association, occupied the chair and Mr. W. A. D. Short acted as Secretary. The first business was an informal discussion of the work that is to be done by the committees. Prominent members recommended that the committee on Organization be abolished, on account of the difficulty of formulating recommendations; but after a brief discussion the majority proved to be in favor of continuing the committee for the purpose of gathering and recording information concerning the practice of different roads. The sentiment was in favor of making this a permanent committee to keep informed as to changes in organization which may occur, and to report to the Association whenever circumstances may demand a report.

Mr. Christofferson, Chairman of the committee on Standards, has assigned to individual members of his com-

mittee the work of making certain plans, or getting them made, and in this way he hopes to be able to report something at the next annual meeting. Mechanical interlocking is the only branch of the subject that he has yet taken up. He finds much diversity in the screw threads used in signaling apparatus and desires to have the Association adopt standard threads.

Attention was called to the fact that to try to standardize all of the things used in interlocking is at present a hopeless undertaking, and it was pointed out that aside from the main features, such as the best settled parts of machines and the ordinary designs of posts, but few details can be profitably considered by the committee on Standards. Jaws, compensators and cranks can perhaps be agreed on, but to go much beyond this will impose an impossible task. One member said that he had been postponing the establishment of standard plans waiting for this committee to make a recommendation.

The committee on Costs has gathered a good quantity of information and expects to make a report at the next meeting.

The proposition to amend the By-Laws so that the holding of some of the meetings each year shall be optional with the executive committee received no more favor at Chicago than at New York; but the meeting adopted the following resolution, to be laid before the Association at its next meeting: "The meetings of the Association shall be held on the second Tuesday of the months of January, March, May, September and October; the October meeting to be the annual meeting."

In the discussion of the question of dealing with snow at interlocking plants in severe storms, Mr. Rhea (P., C. C. & St. L.) advocated a rule, which is now in force on his road, giving to the road which maintains a joint interlocking plant authority to clear the snow from the whole of the plant. That is to say, to go on to the premises of other companies, if necessary, in order to promptly remove obstructions and to keep plants in efficient working order. His agreements with other companies now include a clause allowing this, and making the cost of removal of snow a charge against maintenance. If the other road keeps its derails and other fixtures clean, he does not disturb them. A number of members objected to the practice of sending workmen on to another road and it was urged that Mr. Rhea's arrangement was not necessary, as in case the other road should neglect the cleaning of its track and switches it would itself be the only sufferer. This view seemed to be held by most of the speakers. Mr. Christofferson does not clean the switches and connections on other roads except at a few places where his own company has to bear the whole expense. Where, however, a plant is so small and remote that it is uneconomical to send two men to clean it, he would have one man attend to the switches and connections of both roads. There was inquiry for a practicable method of clearing away snow by heat (by means of steam pipes) but no one proposed anything. Mr. Shaver, Mr. Christofferson and Mr. Markley united in the view that boxing is unnecessary and undesirable for pipe lines.

Mr. Rhea has recently built a second main track on 37 miles of his road, and in redistricting the line for the track repair work he has left only one important interlocking plant to be attended to by each gang; and besides this, to provide for the severe weather of the present winter, he authorized the section foremen to employ extra men promptly, when necessary, to keep switches cleared of snow or ice.

In case of a long continued snowstorm it is important to have extra men on your list, so as to relieve the regular men before they are exhausted.

Mr. Shaver had found it necessary in a severe storm in Nebraska to keep 80 men on duty to attend to 85 switches.

The meeting next took up Mr. Delano's proposition to use two red lights in a horizontal plane for a stop signal on semaphores and two green lights in the same position for "proceed." As at the New York meeting, the discussion turned largely on the practice of the Chicago & North Western, where two lights are shown side by side from a single flame, but of different colors. Some who had examined the North Western light criticized it, but all who had had experience with it spoke well of it. It appears that some modifications have been made within the past year or two in the North Western distant lamp. Mr. Hope, who uses these lamps, has taken out the green lens in the front of one side of the lamp and has substituted for it a green glass between the flame and the mirror; so that, while he gets the same color as before, he avoids the liability of a wrong indication in case of the breakage of the front lens. The mirror is made of metal and therefore is not breakable. Mr. Peabody, of the North Western, announced that he expected soon to have some accurate tests made of the candle power of each color in his distant signal lamps. Mr. Shaver, of the Union Pacific, who uses the North Western style of lamp, has made an improvement by setting the mirror at a more accurate angle.

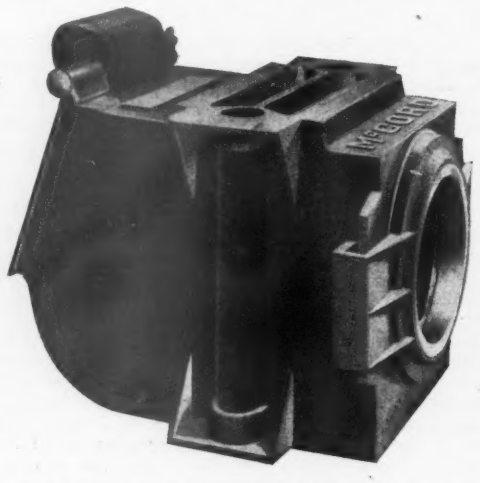
On the main proposition of Mr. Delano the opinion of the meeting was decided that for a double indication to be useful it should have two separate lamps, but that there was no demand for it in practice. The view that a semaphore should be treated as a more important signal than a train order signal was combated. In the words of Mr. Clausen:

"Automatic and train order signals are as important as interlocking signals; to be consistent we ought to use double indication on those as well. It is a step in the wrong direction to try to telegraph to the engineer before he arrives at a signal what the signal means. It is perfectly feasible to operate a railroad with three indications, 'Stop,' 'Proceed' and what is called the 'Caution' indication; and we can get each of the three from a single lens."

Mr. Rhoads (C., C., C. & St. L.) said that he should have to object to a difference between train order signals and other signals, because at his block signal stations on single track a single signal answers both for the interlocking and the train order signal. Mr. Rhoads' company adopted yellow for distant signals about three years ago and the universal testimony is that it is entirely satisfactory.

## McCord Journal Box With Outside Dust Guard.

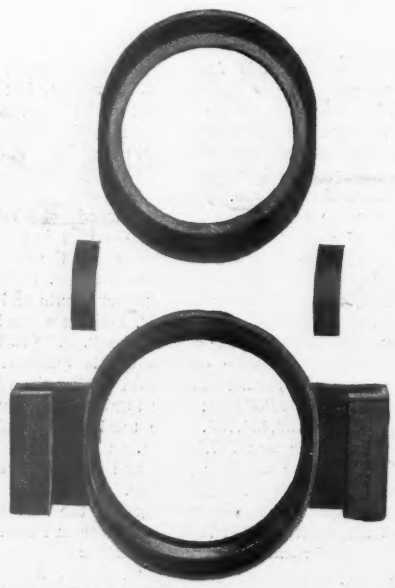
The one objection encountered by McCord & Company in the sale of the McCord journal box has been that while the front of the box was dust-proof, the rear was no better than any other box on account of the lack of an efficient dust-guard. This objection is met by the new box which is now being put upon the market which gives complete protection to the journal at the rear of the box as well as the front. The attempt to make a dust-proof and oil-tight joint between a rough casting and a wood or



McCord Journal Box With Outside Dust Guard.

metal guard has been abandoned and the problem solved in a radical but entirely mechanical way.

The dust-guard slot is cut entirely off from the standard box. Around the opening for the axle in the rear a slight boss is cast which is ground to a plane surface. Flanges extending to about two-thirds of the height of the box, and ¾ in. wide, are cast on the sides of the box at the rear. The dust-guard itself consists of a gray-iron ring turned to fit the dust-guard seat of the axle, enclosed and carried by a malleable-iron shell which is held to the back of the box by springs encased in the



Dust Guard, Malleable Ring and Springs.

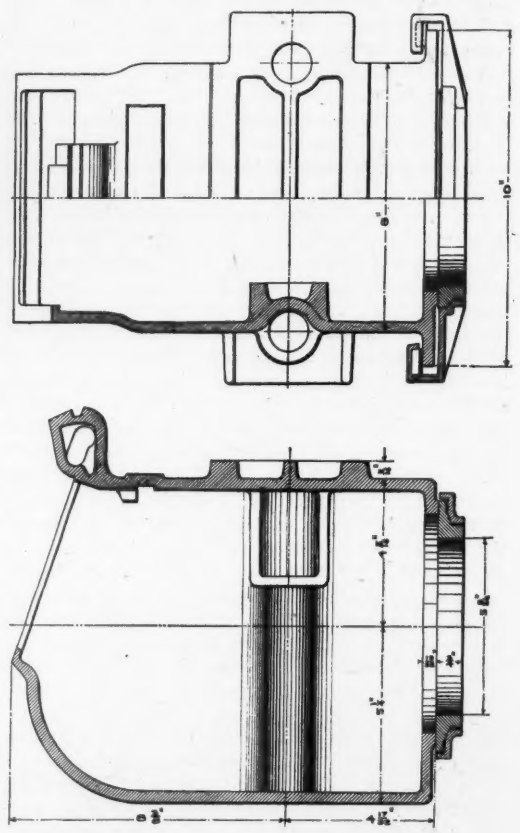
hook lugs overlapping the box flanges. The surface of the dust-guard ring next the journal box is ground to a plane surface.

The action of the guard is as follows: The springs force the malleable-iron shell against the gray-iron ring and the latter is in turn forced against the ground surface of the boss around the rear opening of the box. The springs are strong enough to carry the entire weight of the guard so that no weight rests upon the axle. The guard is free to move with the axle in any direction. A machined joint connection is therefore obtained between the box, the guard and the axle in all positions.

The surface of the gray-iron ring in contact with the malleable shell is beveled and there is a corresponding bevel on the shell. The gray-iron ring can be made in sections if desired, and if so made the beveled surfaces of the malleable shell and the gray-iron segments coming in contact under strong pressure tend to force the segments towards the center of the circle and to take up any wear which might occur on either the dust-guard or the axle. The advantage of the compensating feature with this guard, however, is more or less theoretical, as there is so little wear on the solid guard that in service it would probably never have to be renewed during the life of the car. Tests of this guard in passenger and engine tender service have shown a mileage of upwards of 100,000 miles with less than $^1/_{64}$ in. wear on either the ring or the axle. The mileage so far made demonstrates that the guard will undoubtedly last as long as the ordinary freight car.

Some of the advantages claimed for the guard are, that it consists of fewer parts than any other dust-guard, four pieces forming a complete guard; it is composed entirely of metal and cannot be destroyed by hot box; it raises the oil level at the back of the box as high as the center of the journal, amounting to from 3⅛ in. to 4 in. The dust-guard slot being eliminated, the guard cannot become clogged and if the compensating guard is used there is no possibility of dirt interfering with its action. It gives ⅝ in. more clearance between the back of the guard and the hub of the wheel than exists in the box with the dust-guard slot, this feature eliminating the cause of a large percentage of journal box failures.

The same malleable-iron shell is interchangeable for either the compensating or solid dust-guard ring. On account of the saving in the weight of the box proper, the



Plan and Vertical Section of McCord Journal Box With Outside Dust Guard.

cost of the box complete with this guard is very little in excess of the ordinary box with wooden dust-guard. If it is ever necessary to apply new wearing rings, they can be made by the railroad company or bought for about 5 cents per box. The McCord box with the outside dust-guard has been specified on about 5,000 cars, among which are 1,000 for the New York Central and 100 for the Denver, Northwestern & Pacific, now being built.

## Michigan Railroad Commissioner's Report.

The Railroad Commissioner of Michigan, Theron W. Atwood, has issued the 31st annual report of his department. There has been no material change in the condition of the railroad companies during the year. All of them are very prosperous. There are now about 500 miles of electric interurban railroads in the State, and these do not report their business to the department. The commissioner says that the amount of business done by these electric lines is limited only by their capacity. The great increase in this class of roads has enhanced the dangers at grade crossings. There are now 8,764 highway crossings in the State. The Commissioner has arbitrary power to require flagmen or gates at such crossings, and he remarks that if he were to exercise his power recklessly great injustice might be done. Numerous complaints have been received alleging dangerous conditions at crossings, but all of them have been disposed of, "to the apparent satisfaction of the complainants." How this result was accomplished is not stated in the abstract from which we quote. The crossings protected by gates or flagmen now number 601; and 184 have electric bells. Complaints regarding insufficient fences have also been numerous and have been disposed of with equal satisfaction, but how, is not stated. In

the northern part of the State many new highway crossings have been opened during the past year.

By a law passed last year electric railroads are now subject to the Commissioner, so far as concerns the police power of the State, and he has had all of the lines inspected. In nearly all cases they are well built and operated.

The total mileage of (steam) railroad in the State is given as 8,366, but these statistics are a year old. Much second main track has been built during the past year by the Michigan Central and by the Grand Trunk Western. All of the roads have done a great amount of straightening curves and reducing grades. Eight passengers, 46 employees and 143 other persons were killed on the railroads during the year 1902. The number of trespassers killed increases, and the Commissioner calls attention to the fact that the public makes use of the track too freely as highways. Referring to the collision at Durand, August 7, where 22 persons were killed, the Commissioner calls attention to the fact that the circus cars were not equipped with hand-brakes, but he holds that "in consequence of the nature of the business done by the train" it was not possible that it should be fully equipped with hand-brakes. The immediate cause of the collision, as readers of the *Railroad Gazette* have already been told, was the failure of the engineman to maintain pressure in the air-brake reservoir.

In the city of Detroit about a dozen street crossings have been abolished by separation of grades, the railroads, by agreement with the city, doing the work, and the city bearing the cost of damages to land owners. These railroads (the Michigan Central, the Lake Shore, the Grand Trunk Western, and the Detroit United Railway) have agreed to spend at least $200,000 a year on this work. The expectation that a bridge will be built across the Detroit River in the near future has hindered action concerning certain grade crossings in Detroit. "It is confidently expected" that Congress will at its present session pass an act to enable the railroad companies to build the proposed bridge between Michigan and Canada. This grade crossing abolition which has been carried out in Detroit has been done without any appeal to the law or to the courts.

The suit to compel the Grand Rapids & Indiana to reduce its passenger fares to 2½ cents a mile is still pending in the United States Court. A similar action has been begun against the Detroit, Grand Haven & Milwaukee. The Grand River Valley has complied with the order of the Commissioner to reduce its fares to 2½ cents. The United States Supreme Court has sustained the validity of the tax law of 1897, which was challenged by the Wisconsin & Michigan Railway Company.

The railroads are renewing many bridges. Concrete masonry is becoming general and the use of tie-plates is more and more general. Where new and heavier rails are laid, spring rail frogs are usually adopted. Frogs and switches are generally blocked. Surface cattle guards are used. Woven wire fencing is being used instead of barbed wire. Highway crossing alarm bells are not proving so satisfactory as had been hoped for, and the Commissioner thinks that they do not receive proper attention. He holds that when properly maintained they afford reasonable protection for "certain kinds of crossings."

## "The Southwest Limited" of the C., M. & St. P.

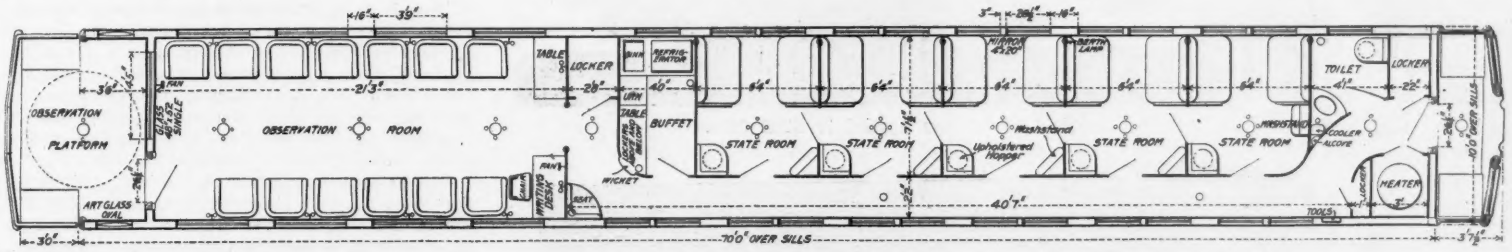
New passenger equipment for its Chicago-Kansas City line was put in service last month by the Chicago, Milwaukee & St. Paul at the time of opening for traffic its new short line between the points mentioned. The new train is called "The Southwest Limited," and is said to be as fine as the "Pioneer Limited" to St. Paul and Minneapolis. It is made up of baggage, day and dining cars, standard sleeping cars and a compartment sleeping and observation car. A floor plan of this latter and two interior views are shown in the engravings.

The compartment sleeping and observation car is 70 ft. long over end sills and 10 ft. wide over side sills. It has the C., M. & St. P. standard cross-section dimensions, which are higher than the general standard. There are five staterooms each 6 ft. 4 in. wide, and each of which is finished in a different wood, as indicated by the floor plan, the woods being Circassian walnut, dark mahogany, tiger wood, light mahogany and Tonquin wood. Each room is treated in a special color study to harmonize with the wood, and is ornamented with beautiful designs in marquetry. The ceilings are a vaulted design and are done in blended colors of various tones and ornamented in gold. The seat coverings are of frieze plush of a special design used for the first time in these cars. The floor covering is Wilton carpet of pattern and color to suit each different room. The window lights are plate glass and art glass in hard metal frames of special design. The observation room, which is 21 ft. 3 in. long, is finished in light mahogany and ornamented with marquetry. There are 13 chairs upholstered in the same design of frieze plush as is used on the stateroom seats. There is an observation platform at the rear which extends 3 ft. back of the usual vestibule platform.

The sleeping car is 2 ft. longer than the sleeping and observation car, or 72 ft. over end sills. The general cross-section dimensions are the same as the latter, which gives more space in the sleeping berths than the ordinary standard. The inside finish of these cars is in St. Jago mahogany of unusual beauty. The berth fronts and bulkheads present a fine appearance, being inlaid with marquetry designs of special study, the effect being quiet but pleasing. The surfaces have been given a high polish by hand. The ceilings are of Empire design and colored in a soft shade of green. The floor is covered with Wilton carpet and the seats are upholstered in the special design of frieze plush used in the sleeping and observation car.

The dining cars are 70 ft. long and 10 ft. wide. They are quite similar to the dining cars put in service on the "Pioneer Limited" something over a year ago and described in the *Railroad Gazette*, Aug. 15, 1902, p. 635.

The day coaches are 60 ft. 6 in. long and have the same cross-section dimensions as the other cars. The interior woodwork is St. Jago mahogany decorated with marquetry designs. The deck lights are of opalescent glass and the seats, which have the Barney & Smith patent movement, are covered with frieze plush. The exterior of the entire train is finished in the C., M. & St. P. standard yellow, with upper outside lights of opalescent glass to harmonize. The cars are mounted on C., M. & St. P. standard six-wheel trucks and have Standard steel platforms with wide vestibules. The train is lighted by electricity from a plant in the baggage car. The sleeping cars have combination electric and Pintsch gas fixtures, and the day cars have oil lamps for emergency. Electric fans are placed in the cars for ventilation and the sleeping cars have electric berth lights. The cars were built by the Barney & Smith Company.



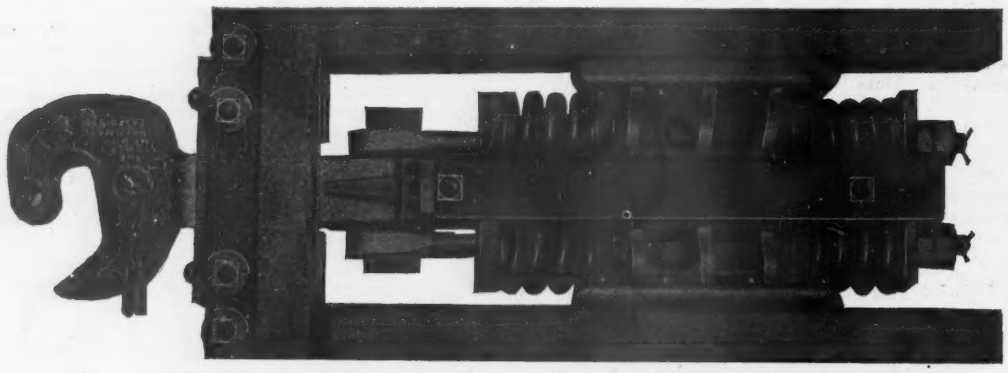

**Floor Plan of Observation and Compartment Sleeping Car for the Chicago, Milwaukee & St. Paul "Southwest Limited."**

**Observation Room, C., M. & St. P. "Southwest Limited."**

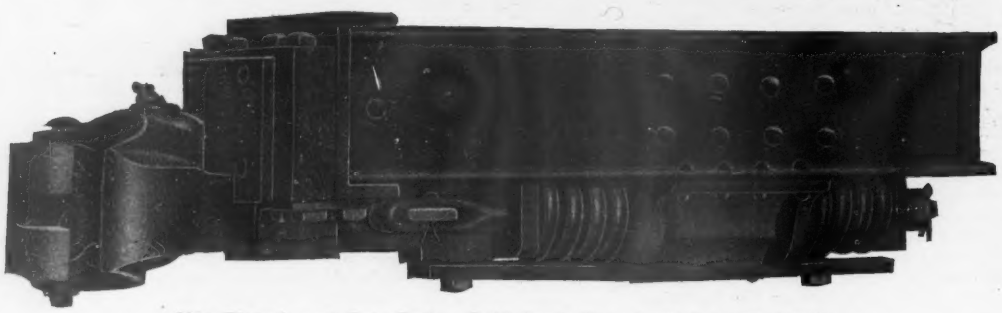
**Compartment in Observation and Compartment Sleeping Car.**

### The Solid Draft Rigging.

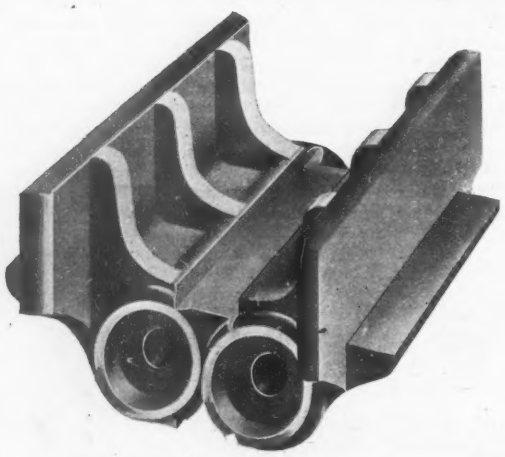
A new spring draft gear, known as the "Solid Draft Rigging," is shown in the engravings. Its principal feature of difference from other spring gears is an immovable spring bearing of peculiar design, which is rigidly secured to the center sills of the car or tender. It has vertical and horizontal flanges through which pass the rivets or bolts for securing it to the sills. Socket spring seats are formed on each end of the bearing, and passing longitudinally through springs, followers and bearing are two pull-rods secured at their slotted forward ends to a key which passes through a corresponding slot in the drawbar shank. The back ends are threaded and have



Plan View of Four-Spring Solid Draft Gear Applied to Steel Sills.



Side Elevation of Four-Spring Solid Draft Gear Applied to Steel Sills.



Spring Bearing for Four-Spring Gear.

nuts back of the rear follower which enable all lost motion to be taken up.

The engravings show a four-spring gear. There is also a three-spring design having twin springs behind the bearing and a single spring in front, the latter being between the pull rods and bearing against the drawbar shank; and a two-spring design intended especially for baggage and day cars, and cabooses. The design of the gear is simple and there are few parts. All of the parts are in common use on railroads except the spring bearing, and it is of such substantial construction that breakage is not taken into consideration. It is furnished in cast steel, malleable or cast iron. The parts of the gear are in plain view, making inspection easy, and any one part can be readily removed without interfering with the rest.

The gear has already been in service on a number of locomotives for three years, without a failure, it is claimed. The further claim is made that it has been in several bad wrecks where the locomotives were badly damaged and the steel tank frames destroyed, without any failure of, or harm to, the draft rigging. It is now in service on the Southern Indiana and Illinois Southern railroads. It is owned and sold by The Solid Draft Rigging Company, Terre Haute, Ind.

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The piety of the Mussulmans in building the long railroad to Mecca for the benefit of pilgrims seems likely to be rewarded, if we may trust a report that near its line east of the Dead Sea vast quantities of minerals, such as salt, chlorate of potassium, bromides, phosphate of lime, asphalt rock, pure asphalt and petroleum are found, which a little capital and enterprise will make available. Besides the railroad from Beyrout to Damascus, by which the Mecca Railroad now receives its materials, there is talk of three other connections with the sea, one from the Mediterranean at Haifa eastward touching the Lake of Tiberias, already partly built; a second by an extension eastward through Jericho of the Jaffa & Jerusalem Railroad, and one from the Red Sea at Accaba.

### The Washburn Compound Coupler.

The difficulty and frequent impossibility of coupling locomotives and cars on curves often makes necessary the use of some special connection until straight track is reached. To overcome this difficulty by a coupler which has sufficient lateral movement to enable it to couple on the most severe curves, the Washburn Company, Minneapolis, Minn., has brought out the design shown in the engravings.

The drawings show the construction and possibilities of the coupler clearly, so that little explanation is needed. Two pivotal points are provided; the effect of one is equivalent to allowing the bar to swing, and the other allows the head to swing in the bar. Intermediate between the head and the back plate is a casting, U-shaped in cross-section, which is normally held central by the spiral springs on the sides. The action of the coupler on a curve and the amount of lateral motion it has is shown in Fig. 2.

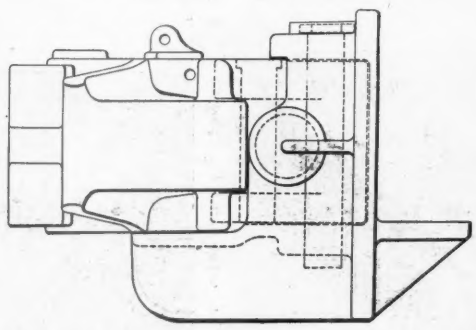


Fig. 1.—Side Elevation, Washburn Compound Coupler for Locomotives.

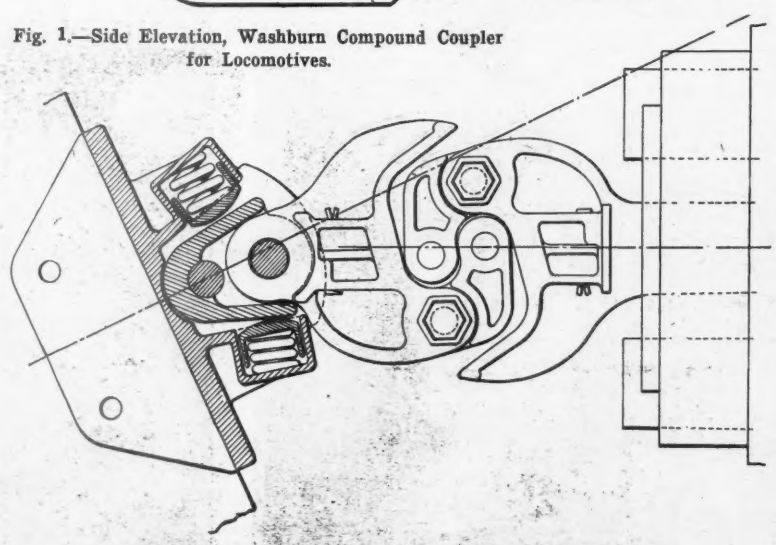


Fig. 2.—Action of Washburn Compound Coupler on Severe Curve.

To prevent sagging of the head in case of wear of the pins, a shelf is extended forward from the main casting, having a large flat bearing on which the head rests, and which maintains it in horizontal alinement. The compound coupler is simple in design and is said to give good results in service.

### Electrification of the Lancashire & Yorkshire.

About 12 months ago it was announced that the Lancashire and Yorkshire Railroad Company intended to electrify the portion of its line between Liverpool and Southport. A start was made early last year upon the work, which has steadily and quietly progressed. The original scheme has since been extended, and a service at certain times of day will be given to the stations as far as Crossens on the north side of Southport on the old West Lancashire line, so that the residents in the districts will eventually be able to go to and return from Liverpool without change of carriage. The length of line to be electrified amounts in all to about 23 miles of double track, nearly all of which has been completed. All the high-tension alternating cables have been laid. The sub-station buildings are all completed, and progress is being made with the erection of machinery in them. The rolling stock is nearly completed, and is being fitted up with the electrical equipment. The power house building is finished, and every effort is being made to get the machinery ready for operation early this year. Satisfactory experimental runs were made a few days ago with one of the new four-car trains between Southport and Formby, the high-tension alternating current being obtained from the power house at Formby, and transformed into direct current at the Birkdale sub-station to supply the current for the train.

The trains are composed of two first and two third class cars, the third class cars being equipped with four motors of 150 h.p. each, making a total of 1,200 h.p. per train; to operate these motors current is obtained from a third-rail alongside the running tracks, which is fed with direct current at about 600 volts from four sub-stations, three of which are situated at Birkdale, Seaforth, and Sandhills respectively, and another in the main power house building at Formby. These sub-stations are provided to transform and convert the high-tension alternating current from the main power station at 7,500 volts, into direct current.

The power station which adjoins the railroad, on the banks of the River Alt, at Formby, is a building 290 ft. long x 130 ft. wide, and consists of an independent steel structure, the steel stanchions of which, in addition to carrying the roof, support traveling cranes over the engine-room, the spaces between the stanchions being filled with brickwork. It has two spans, one containing 16 Lancashire boilers, 8 ft. 6 in. in diam. and 32 ft. long, for a working pressure of 160 lbs. per sq. in., together with superheaters, feed pumps, induced draught plant, etc.; the other and larger span contains four horizontal, cross-compound, condensing engines of 1,500 kw. capacity, also one subsidiary, vertical, compound, condensing engine of 750 kw. capacity, capable of taking large overload for short periods. The generators connected with these engines are of the 3-phase type, with a periodicity of 25, and a voltage of 7,500. The engine-room also contains steam-driven exciters, sub-station plant, and a main switchboard. Three-core paper insulated metallic sheathed cables convey the high-tension current to the sub-stations, and are laid on what is known as the "solid system," at a suitable depth along the company's permanent way.

The sub-station equipments consist of static transformers, which transform the 3-phase alternating current of 7,500 volts to low-tension alternating current, from which it is converted in rotary converters to direct current at 600 volts. The rotary converters are nominally of 600 kw. capacity, four being provided in each sub-station, and three static transformers, cooled by means of air blast, are provided in connection with each rotary. The connections from these sub-stations to the third rail are made by insulated copper cables, run underground in troughing.

The third rail, of Vignoles section, is of special steel, weighing 70 lbs. to the yard, and is supported at intervals of 10 ft. on insulators, the center of the rail being 3 ft. 11½ in. from the center line of the track, and the top of the rail 3 in. above the surface of the track rails, these being dimensions agreed upon between all the railroad companies. Timber guarding is provided at all the busy places on the line, to prevent the possibility of any person coming in contact with the third rail. For the return, an exactly similar rail, supported on wooden blocks, has been placed in the 4-ft. space between tracks, bonded, of course, to each running rail.

The electric cars are 60 ft. long and 10 ft. wide, being the widest cars in England. This width was adopted

because it was found before any operations were begun that it was possible on the Southport line, as distinguished from other parts of the main line, to have wider rolling stock, some slight alterations to the permanent way and some trifling ones to the platforms along this length alone being necessary. The cars have center passages throughout, with vestibules to allow passage from one car to the next.

The motor cars are placed at the ends of the train. The front end has a small compartment for the motorman, containing all the apparatus for controlling the train; and near this is a baggage compartment, the remainder of the car being devoted to passengers. Most of the seats are cross-wise, to seat three on one side of the passage and two on the other, but at the ends they are fixed length-wise, to allow more room for passengers entering or leaving the cars. The cross seats are reversible, so that passengers may sit as they choose. The trailers or first class cars have seats arranged after the same design, but only two on each side of the passage. Special attention has been given to the electric lighting and heating of these vehicles. A four-car train will carry 270 passengers, the third class seating 69 and the first class 66 people.

The company has taken every possible precaution against fire in the cars. The motor compartments, with the exception of the roof, which is covered with sheet-steel plates, have been lined with uralite, a well-known fireproof material, the floor also being fireproof. In addition to the cable troughs, in which the cables are placed for conveying current to the motors, and equipment, being lined with uralite, the whole of the floor over the motors is covered with the same material and thin steel plates. All the trains carry fire appliances, and ample steps have been taken to insure safety in this respect, though the danger from fire on surface lines is very small.

The vacuum brake used on the trains is, with some slight differences, the same as that used on the regular trains of the Lancashire and Yorkshire Railroad. It is fitted with quick-acting valves, an exhauster being provided in place of the steam ejector on the locomotive. This is the first case of the use of the vacuum brake upon electrically worked trains.

The electrical equipment consists of four 150 h.p. motors on each motor-car, with a controller capable of controlling all the motors on the train, together with the necessary switches, gages, and circuit breakers in each motor compartment. Under the floor of the car are placed the resistances and reversers for the electrical control. Mounted on each side of the truck frame are cast-steel shoes, which pick up the current from the live rail. The current is returned through the wheels to the running rails, and thence to the center rail, and then back to the power house. Between the cars connections are provided for operating the rear motors from the front end.

When the service starts there will be a service of local trains in both directions between Liverpool and Hall Road with not more than 10 minutes' interval; every second train will go on as a local train to, or come from Southport, thus forming a service to Southport every 20 minutes. In addition to this, however, there will be an hourly express in each direction between Liverpool and Southport, and at certain times the trains arriving at Southport from Liverpool will go on to Crossens. The local trains between Liverpool and Hall Road, and those between Liverpool and Southport, will be run in less time than at present, but it is not intended that the expresses to Southport shall do the journey in less time than the fastest steam trains now running. The whole of the work, with the exception of the rolling stock, which is being made at the Horwich and Newton Heath Works of the railroad company, is being carried out by Dick, Kerr, & Co., Ltd., of London and Preston, who are now fast completing at their Preston works the main and subsidiary generators, the sub-station equipment, the control equipments of the trains, and other electrical plant.

We are indebted to the *Mechanical Engineer* of London for the details of the above description.

## Foreign Railroad Notes.

The Austrian rolling mills have a "rail pool" which has existed now for 25 years. The mills maintain uniform prices and divide orders in agreed proportions. The total production the first year was 37,800 tons; it rose to 96,000 in 1898 and fell to 72,500 in 1902. Present prices are $37 per ton. The pool contract has just been extended to June 30, 1912.

The movement in Germany to promote temperance among railroad employees makes progress. This is shown especially in various governments, which are distributing tracts on the misuse of alcohol, especially a publication issued by the Imperial Bureau of Hygiene. Bavaria has recently directed its distribution at the lodging house where trainmen stay over night, in shops, offices, etc. Until recently there seemed to be no official sympathy with the movement.

The socialist newspapers in Germany declare that the laborers employed on the State Railroads are overworked and underpaid. In reply to a charge that the average pay of laborers on the Prussian State Railroads was but $335.50 per year, a well-informed journal answers that this fails to take into consideration the amounts paid for pensions and towards house rents, which raise the average yearly wage to $359. It is claimed that everywhere State Railroad laborers' wages are at least as high as the current rate for similar work in the locality, and that during the recent depression of business, which made it hard to get work, the government kept many men whose services were not required, instead of dismissing them, as a private employer would have done. The average wages of railroad laborers have increased 25 per cent. within the last 10 years. These facts affect only the laborers engaged by the day and not permanently employed. The regular corps of employees, who cannot be discharged except for cause, have their wages and allowances fixed by law, and are enlisted for life, as it were.

The relative importance of freight on the Swiss railroads must be very small, judged by the freight train mileage, which was but 31½ per cent. of the total train-mileage in 1901. But this misrepresents the matter, because a considerable part of the trains are mixed trains. However, the passenger movement was equivalent to 433 persons and the freight movement to only 302 tons carried each way daily, while in this country it was 123 passengers and 1,042 tons of freight. The density of the passenger traffic in Switzerland exceeds that of New England, even; but there is no section of this country where the freight traffic is so light. The Swiss freight earnings, however, were 40 per cent. more than the passenger earnings, which is explained by the fact that the average passenger rate was 1.49 cents; the average freight rate, 2.46 cents. With these rates the net earnings amounted to 3 per cent. on the capital invested.

## TECHNICAL.

### Manufacturing and Business.

E. S. Mills, Assistant to First Vice-President James Gayley, of the United States Steel Corporation, has resigned, and this office will be abolished.

The R. F. Hawkins Iron Works, of Springfield, Mass., has been incorporated, with a capital of $35,000. Richard F. Hawkins, of Springfield, is President and Treasurer.

The Colonial Iron Company of New York has been incorporated with a capital of $150,000. The directors are: H. H. Adams, W. W. Vanderbilt and E. V. B. Hoes, of New York.

The Syracuse Machine & Tool Company, of Fayetteville, has been incorporated in New York, with a capital of $50,000. The directors are W. R. Grace, C. A. Lawrence, of Syracuse, and others.

George W. Smith, of the Universal Railway Supply Company, Maryland Trust Building, Baltimore, Md., has been appointed southern representative for the Continuous Rail Joint Company of America.

The Vincennes Bridge Co., of Vincennes, Ind., has increased its capital stock to $50,000 and will enlarge its works early in the spring by building a large concrete addition with 20,000 sq. ft. of floor space.

The West Indies Construction Company has been incorporated by Linton Satterthwait, Stephen C. Cook and Edwin C. Long, all of Trenton, N. J., with a capital stock of $100,000. The company is to build railroads and bridges.

The Central Railroad & Bridge Company of Omaha, Neb., has been incorporated to build a bridge over the Missouri River, by S. W. Wadsworth, of Council Bluffs, Iowa, and Abram Sebring and C. C. Clifton, of New York City.

The National Telegraphone Co., of Rochester, N. Y., maker of the Grauel apparatus for talking over telegraph lines and for quickly connecting a car with a telegraph wire, is putting in its apparatus on the Erie, the Southern Pacific and the Rio Grande Western.

Ethan R. Cheney, who for 20 years was Master Mechanic at the Norway Iron Works, Boston, died recently at Brookline, Mass., at the age of 74. Mr. Cheney was the inventor and patentee of many valuable pieces of machinery, including a lathe for turning large granite columns.

The Consolidated Railway Electric Lighting & Equipment Company has elected Colonel John T. Dickinson, hitherto General Agent, Second Vice-President. Mr. Dickinson will introduce the Consolidated "axle light" system of electric car lighting to railroads. The company's general office is now in the Hanover Bank Building, Pine and Nassau streets, New York City.

The Engineering Company of America has appointed H. M. Deavitt, analytical and consulting chemist and assayer, in charge of its Chicago office at 159 La Salle street. Ellis C. Soper, an expert in cement, is connected with the same office, and Edward Everett, C. E., a railroad work expert, who made the survey for one of the Hudson River tunnels, is connected with the New York office, 74 Broadway.

The Walter A. Zelnicker Supply Company, St. Louis, Mo., is to furnish 800 tons of rails for the intramural railroad of the World's Fair at St. Louis. The company has started work on its new car shops at East St. Louis, the Southern Railway having completed its track to the grounds. The Zelnicker Company reports that the year has started with an encouraging business in both the general supply and the railroad and equipment departments.

The Franklin Railway Supply Co., Franklin, Pa., has been formed to succeed the Coffin-Megeath Supply Co., dealer in railroad specialties. Among the articles handled by the company are the Perfection fuel economizer and smoke consumer, Worthington car coupler, McLaughlin flexible conduit, Economy oil cup, McLaughlin lock nut, Benson long-time burner, Interlocking brake-shoe, and Symington journal box. The officers of the company are: Charles Miller, Chairman Executive Board; J. S. Coffin, President; Samuel G. Allen, Vice-President; S. T. Callaway, Secretary, and D. D. Mallory, Treasurer.

The American Bridge Company, it is reported, has secured a contract for structural material to be used in building a great reduction plant for the Cerro de Pasco Mining Company at Cerro de Pasco, Peru. More than 1,000 tons of steel will be used. The contract was let through Frank Kleptko, Maritime Building, Bridge street, who is acting as consulting engineer for the Cerro de Pasco Company. Contracts are expected to be placed within the next thirty days for further equipment for the plant. The Nordberg Manufacturing Company, of Milwaukee, some months ago secured the contract for the engines. Considerable electrical equipment will be ordered.

H. W. Johns-Manville Co., New York, is putting on the market a new insulating material for high tension electric cables for which the trade-mark "Niagrite" has been adopted. It is furnished in strips of several widths from 3 in. to 36 in., suitable for wrapping spirally on electrical cables and is held in place with asbestos fireproof glue, protecting the cables from external fire and confining internal fire. The material presents a neat and permanent finish and is not affected by atmospheric conditions. It has been adopted by the Niagara Falls Power Co., International Power Co., Buffalo Street Railroad Co., New York Edison Co., and other important electrical plants.

The Security Steel & Iron Company of Troy has been incorporated in New York, with a capital of $100,000. The company has bought the old Gilbert Car Works on Green Island and will conduct a general iron and steel business and will manufacture and deal in iron, railroad supplies, etc. The directors are: Senator Edgar T. Brackett, of Saratoga; Judge James T. Scott, of Saratoga; John W. McNamara, of Albany; Thomas H. Campion, of Troy; Frank L. Quinn, of Saratoga; Jos. J. Murphy, of Troy; Edward Murphy, 2d, of Troy, and John J. Ryan, of Troy. The directors elected these officers: President, E. T. Brackett; Vice-President, J. J. Ryan; Secretary, T. H. Campion; Treasurer, Joseph J. Murphy; General Manager, F. L. Quinn.

### Iron and Steel.

The Pennsylvania Car Wheel Company, of Allegheny, Pa., it is reported, has resumed work on full time, giving employment to about 700 men.

The Kemmerer Coal Co., of Kemmerer, Wyoming, is preparing plans for the building at once of 150 coke ovens on its land along Willow Creek.

At the Riverside Works, Wheeling, W. Va., of the United States Steel Corporation, work has been resumed, giving employment to about 1,200 men.

The rail manufacturers have refused to reduce the price from $28 a ton and the railroads refuse to order at that figure. It is said that the orders at the beginning of the year were only about 800,000 tons, as compared with 2,700,000 tons last year.

The American Steel & Wire Company has resumed work at its plant at Rankin, which has been closed for repairs. This is one of the largest of the 13 plants controlled by this company and employs about 1,300 men. The next largest, employing about 1,100 men, has also resumed work recently.

The Carnegie Steel Company, reports say, has since the first of the year put 20 of its blast furnaces at work, and will shortly begin work at its large works at New Castle. At the South Sharon plant, work was recently resumed, giving employment to about 3,000 men. The Carnegie Company is now running its steel works at Homestead, Braddock and Duquesne on full time, and is preparing to resume work at Bellaire and Mingo Junction.

### M. C. B. Committee on Couplers.

The standing committee on couplers of the Master Car Builders' Association has issued a preliminary circular calling attention to the change in the contour lines of couplers, which went into effect January 1, 1904, and the changes made necessary in the contour gages for new couplers and for knuckles. The circular shows, with drawings, the changes which have been made in the contour gages. The general form and construction of the gages remains the same, the only difference being in the dimensions to accord with the newly adopted contour line. The circular is signed by R. N. Durbarrow, Chairman, and by the other members of the committee.

### Bids for Battleships.

The bids opened last week at the Navy Department for the two new 13,000-ton battleships, "Idaho" and "Mississippi," were as follows: Wm. Cramp & Sons, for one ship to be completed in 39 months, $3,200,000, or two ships, one to be completed in 38 months and the other in 40 months, $2,999,500 each; the Maryland Steel Co., Baltimore, Md., one ship to be completed in 42 months, $3,472,000; Newport News Ship Building & Dry Dock Co., one ship to be completed in 37 months, $3,147,000; Fore River Ship & Engine Building Co., one ship to be completed in 42 months, $3,468,000, and the New York Shipbuilding Co., Camden, N. J., one ship in 42 months,

$3,500,000. The lowest bid for one ship was that of the Newport News Company, while the second lowest was that of the Cramps' company, which was the only bidder for both ships.

### Wilmington Malleable Iron Company.

The Wilmington (Del.) Malleable Iron Company has just finished its new malleable iron works at South Wilmington. The shops are situated on a tract of 42 acres. The foundry is 450 ft. x 216 ft.; the annealing room, 210 ft. x 420 ft.; pattern safe, 83 ft. x 56 ft.; carpenter and machine shop, 100 ft. x 77 ft., two stories high, the upper story of which is the pattern loft; office building 45 ft. x 55 ft., two stories high; engine room, 40 ft. x 75 ft., and boiler room 50 ft. x 60 ft. The foundry and annealing rooms are heated by hot air and all the other buildings by hot water. The buildings are all of brick and steel with concrete slab roofs, and all doors and windows and casings are copper-sheathed. The annual capacity of the works is about 12,000 tons and the company is particularly well equipped to do railroad work. The plant is reached by lines of three railroads, the Pennsylvania, the Baltimore & Ohio, and the Philadelphia & Reading.

### A New Type of Geared Ratchet Jack.

A new type of Barrett ratchet jack with a capacity of 30 tons, especially adapted for heavy car work where the lift should be rapid and positive, is shown in the engraving. It operates in the same way as the No. 19 Barrett jack, being single acting and automatic lowering. It is designated by the makers as a No. 30 and is intended to displace the slow and cumbersome hydraulic jack for large loads. Refined malleable iron and the best grade of steel are used throughout in its construction. The lifting bar or rack is of open hearth steel and is raised by a machine-cut, steel pinion which is made integral with a large steel gear having ratchet teeth on its circumference. This gear is rotated by means of a socket lever and pawl. The direction of rotation is controlled by an eccentric at the side of the frame which reverses the action of the retaining pawl when the load is to be lowered. All of the parts are accessible by removing the shield and gear cover without in any way impairing the working of the jack. The method of rotating the gear by a socket lever and pawl requires no special care on the part of the operator, as it is not necessary to pull the socket lever out a short distance in order to engage the next tooth of the gear. The method of operation is simply raising and lowering the socket lever, as in the other sizes of Barrett jacks. Several sizes of this form of jack will be made by the Duff Manufacturing Co., Pittsburg, Pa.


### Detroit & Mackinac Consolidation Locomotives.

With the improvements made in grades and alinement the company expects to haul trains of 70 to 80 loaded freight cars and the new equipment for this purpose is being delivered. The new consolidation locomotives from the Schenectady works have the following dimensions: Cylinders, 21 inches in diameter with 26-inch stroke; eight driving wheels 51 inches in diameter, with a total wheel base of 22 feet 3 inches; diameter of boiler at smoke-box 74⅜ inches, with 376 flues 2 inches in diameter, the steam pressure being 200 pounds to the square inch; fire-box heating surface covers 212½ square feet, and the flues an additional 2,560 square feet, making the total heating surface 2,772½ square feet, the grate area being 34¼ square feet; tender capacity, 6,000 gallons of water and eleven tons of coal; weight on driving wheels, 151,000 pounds; total weight without tender, 168,000 pounds; total weight with loaded tender, 288,000 pounds.

### Pneumatic Tool Litigation.

In an opinion rendered December 21, 1903, the United States Circuit Court of Appeals for the third circuit, sustained the validity of Boyer patent No. 537,629, issued April 16, 1895, and declared the pneumatic hammers made by the Keller Tool Company and sold by the Philadelphia Pneumatic Tool Company to be an infringement of claims 42, 45, 46 and 48, awarding a decree for an accounting and a perpetual injunction against the further manufacture, sale, or use of infringing tools. The claims referred to cover the means for introducing and controlling the air supply, claim 42 reading: "In a pneumatic tool, the combination with the tool proper of a grasping handle secured thereto and having a pressure supply duct extending through it, and a throttle valve in the grasping portion of said handle for controlling said duct, substantially as described." Although the tool of the defendant has the duct traversing only the lower end of the handle transversely, the court holds that the introduction of the pressure-supply duct in this way makes possible the use of a throttle valve in the grasping portion of the handle, which puts the pressure under the easy and complete control of the direct hand of the operator, and therefore infringes the claims of the plaintiff, which broadly cover the combination of a throttle valve in the handle in conjunction with a supply duct running through it.

## THE SCRAP HEAP.

### Notes.

A Chicago paper says that on the Chicago & North Western an order has been issued forbidding delayed passenger trains to make up time.

The State health officer of Texas has prepared a code of rules for disinfecting passenger cars, including sleeping cars, and will shortly publish them.

The State Railroad Commission of Louisiana proposes to establish a uniform bill of lading for the railroads of the State, and will give a hearing on the subject next Tuesday.

A Pittsburg newspaper says that the Pennsylvania Railroad has discontinued 500 passes which have heretofore been issued annually to members of the families of officers of the road.

State Health Officer George R. Taber, of Texas, has issued the rules recently announced for the sanitation of cars; and one of the rules requires that all sleeping cars coming into Texas must be disinfected each trip.

The Southwestern Lumber Association has secured the introduction in Congress of a bill requiring the railroads to furnish an adequate supply of cars to all shippers. This proposition is intended to offset the demurrage regulations of the railroads and to compel the railroads to pay demurrage to shippers as well as collect demurrage from shippers.

The new rule which was adopted on the roads west of Chicago January 1 restricting free-ride privileges granted to drovers has already been modified. The Illinois Central now allows the drover to ride on a passenger train ahead of the train which carries his live stock, and it is expected that the other roads will follow with a similar concession. The defense of this arrangement is based on the statement, said to have been made by a railroad officer, that the facilities for feeding and watering are now so complete that the presence of a caretaker on the freight train is not necessary; and that if the owner can reach Chicago ahead of his animals he can have more time to secure the best price.

### A Grant to Purdue From the Carnegie Institution.

President Stone of Purdue University announced last week that a grant of $5,000 had been made by the Trustees of the Carnegie Institution to Professor W. F. M. Goss to promote research in locomotive testing. At the second annual meeting of the Trustees of the Carnegie Institution, which was held at Washington December 9, more than a thousand applications were considered, 66 of which received favorable action. Among these latter was the Purdue grant. Hitherto aid has been chiefly given to workers in pure science and generally in comparatively small amounts. The grant to Purdue is probably the most significant gift yet made for work in an applied science. The specific purpose of this grant is to aid in carrying out an elaborate study of the value of high steam pressures in locomotive service. In anticipation of such a study, the boiler of the experimental locomotive of Purdue was designed for 250 lbs. pressure; no expensive changes will therefore be necessary to fit it for these tests.

## MEETINGS AND ANNOUNCEMENTS.

*(For dates of conventions and regular mettings of railroad associations and engineering societies see advertising page 16.)*

### Engineers' Club of Philadelphia.

At the annual meeting of this Club, at its club house in Philadelphia, Jan. 16, an address was given by the retiring President, Edward F. Smith, who spoke on some early engineering works in Pennsylvania. The officers elected for the ensuing year were Carl Hering, President; Thomas C. McBride, Vice-President; J. O. Clare, Secretary, and Geo. T. Gwilliam, Treasurer. The present membership of the Club is 497, a gain of 43 members over last year.

### Canadian Railway Club.

At the annual meeting of this Club, held in Montreal, Jan. 5, the following officers were elected: T. McHattie, Grand Trunk, President; S. King, Intercolonial, Vice-President; W. E. Fowler, Canadian Pacific, Second Vice-President; W. H. Rosevear, Jr., Secretary, and S. S. Underwood, Treasurer. The Secretary's report showed that the Club had been very prosperous in 1903, the membership now being 331. The annual dinner of the Club will be held the third week in January.

## PERSONAL.

—Mr. C. S. Hall, who for the past 31 years has been in the service of the Boston & Maine, and who has recently become Master Mechanic at Springfield, Mass., succeeding Mr. Aiken, is 44 years old. Mr. Hall was born in Troy, Me., and when a mere boy entered the station agent's office at Lawrence, Mass. Later he worked as freight brakeman, yard conductor, and fireman, and in 1879 he became an engineman, and ran on the Western and other divisions of the road 16 years. Then for one year he was inspector of the motive power department and for the past two years he has had charge of air brake matters. On the first of this month he was appointed Master Mechanic at Springfield.

—Mr. W. P. Appleyard, who on February first becomes Superintendent of Equipment of the Pullman Company, is 47 years old. Mr. Appleyard is one of the best known car builders in the country. He has taken a prominent part in the Master Car Builders' Association and has served on many important committees. He was a valued member of the committee which supervised the 1903 edition of the Car Builders' Dictionary. At the last meeting he was elected First Vice-President of the Association. He was educated at the Notre Dame University at South Bend, Ind., studying engineering and architecture. Two years after graduating he went into business with his father, who was a contractor and who built the State House at Lansing, Michigan. He then followed his profession as an engineer and architect until 1888, when he went to the Pullman Company as Mechanical Inspector, and later as Superintendent of Repairs. He remained with the Pullman Company until 1893, when he went to the New Haven road. Here he was put in charge of the car shops at Boston with the title of General Foreman of the car department of the Old Colony System. In 1895 he was promoted to the superintendency of the car department of the whole road and has held that position ever since, his title being Master Car Builder. He will be in charge of maintenance of equipment at the Pullman, Denver, St. Louis, Wilmington and Buffalo shops, and his headquarters will be at the Chicago office.

—Mr. Nicholas D. Maher, of the Norfolk & Western, who has been promoted from the office of General Superintendent to be General Manager, is a native of Blairsville, Pa., having been born in that city 50 years ago. He was educated at Mount St. Mary's College at Emmitsburg, Md., and went to work at the age of 17, and for two years was engaged on survey and construction work on the Pittsburg, Virginia & Charleston. In 1873 he went to the Pennsylvania as clerk in the office of the Superintendent of Transportation at Altoona, and for the nine years following 1874 he was in the General Superintendent's office. In 1883 he went to the Norfolk & Western as chief clerk to the General Manager. This position he held for six years, and then for one year he was in charge of transportation in the Flat Top region. For a short time then he was Superintendent of the Pocahontas and Clinch Valley Divisions, but resigned from this company in 1901 to become General Superintendent of the Seaboard Air Line. He remained there for about two years when he went back to the Norfolk & Western as General Superintendent.

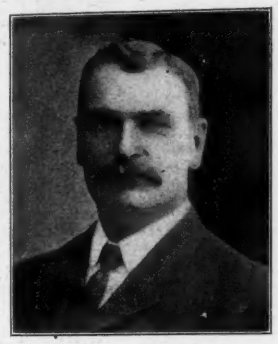
—Mr. John W. Parsons, who formerly for many years was General Passenger Agent of the Wabash, died in Toledo, Ohio, last week, at the age of 79.

—Mr. R. E. McCarty, Superintendent of the Pittsburg Division of the Pittsburg, Cincinnati, Chicago & St. Louis; Mr. A. H. Rudd, Assistant Signal Engineer of the Pennsylvania Railroad, and Mr. Andrew Keiser, Superintendent of Telegraph of the Pennsylvania, have gone to Europe, where they are to study British and Continental railroads for two months. They expect to visit England, France and Germany.

—Mr. W. H. Benn, who on January 1, became General Freight and Passenger Agent of the Newton & Northwestern Railroad (Iowa), is 38 years old. He began his railroad work on the Chicago, Burlington & Quincy as a telegraph operator, and later went to the Minneapolis & St. Louis. From this road he went to the Illinois Central as General Agent at Monmouth, Ill., which position he held for about two years.

—Mr. George Francis Train, an eccentric character and formerly well known throughout the country, who died in New York city last week, was known to the present generation chiefly by his eccentricities, but in a former generation he was a railroad promoter, having been one of the active originators of the Atlantic & Great Western in 1858, now a part of the Erie Railroad. A few years later he built street railroads in Europe and afterwards in Asia and Australia. It is said that he was the first builder of street railroads in England. Later he was connected with the promotion of the Union Pacific.

—Mr. Marion M. Richey, who was recently appointed Assistant General Superintendent of the Southern Railway in charge of the Western District, was born in Delaware County, Ind., in 1855. He worked on a farm until he was about 17 years old, and began his railroad service in 1873 as a brakeman on the Pittsburg, Cincinnati, Chicago & St. Louis. In 1875 he went to the Cleveland, Cincinnati, Chicago & St. Louis as a fireman, but remained there but a short time. From there he went to the Lake Erie & Western and in 1877 was made an engineer, and two years later local freight conductor. Mr. Richey served on this road until 1890, when he went to Chicago as yardmaster on the Chicago, Lake Shore & Eastern; and in 1891 he was made Superintendent of that road. Three years afterwards he was promoted to the General Superintendency. In 1899 he went to the Central Railroad of New Jersey as Trainmaster, but was soon promoted to be Superintendent of Terminals at Jersey City. In 1900 he was appointed Division Superintendent and in 1901 was made Acting General Superintendent. In 1902 he resigned to go to the Southern Railway as Superintendent of the Birmingham Division and on the first of this month he was promoted to be Assistant General Superintendent of the Western District as above noted. This district includes the Asheville, the Knoxville, the Memphis, the Birmingham, the Mobile and the Atlanta Divisions, in all about 3,300 miles.



—Mr. Levin J. Houston, Jr., the new Division Engineer of the Chesapeake & Ohio, at Ashland, Ky., was born at Stockton, Md., 27 years ago. He is a graduate of the Maryland Agricultural College, class of '98; also of Cornell University, from which he received the degree of C. E., in 1901. Immediately after leaving college he went to work for the Canadian Pacific as a leveler in the construction department, and was successively promoted to be transitman, resident engineer on location and construction, and assistant engineer. For a time he assisted in dynamometer tests in connection with grade reduction, and finally became Resident Engineer of Maintenance of Way, which position he held at Fort William, Ont., during the year 1902. In December, 1903, Mr. Houston went to the Chesapeake & Ohio and is now promoted to succeed Mr. Hoadly as Division Engineer at Ashland, Ky. He is an Associate Member of the Canadian Society of Civil Engineers.

## ELECTIONS AND APPOINTMENTS.

*Atchison, Topeka & Santa Fe (Coast Lines).*—W. F. Buck, hitherto Master Mechanic of the Northern Pacific at Missoula, Mont., has been appointed Division Master Mechanic of the Arizona Division of the A., T. & S. F., C. L., with headquarters at Needles, Cal., succeeding Hugo Schaefer, resigned.

*Baltimore & Ohio.*—George F. Randolph, hitherto General Superintendent at New York, has been elected First Vice-President, succeeding Mr. Murray, recently elected President of this company.

*Bessemer & Lake Erie.*—E. H. Utley has been elected Vice-President, with headquarters at Pittsburg, Pa., succeeding D. M. Clemson, resigned.

*Brunswick & Birmingham.*—F. L. Lamar has been appointed Superintendent of Car Service, with headquarters at Brunswick, Ga., succeeding J. R. Mangham, resigned.

*Canadian Pacific.*—Frank Lee, Signal Engineer, has been transferred, and all communications concerning signal matters should be addressed to the Engineer of Maintenance of Way.

*Erie.*—David Bosman has been elected Secretary and J. E. Packer, Assistant Secretary.

*Grand Rapids & Indiana.*—J. H. P. Hughart, General Manager, has been granted a four months' leave of absence, and W. B. Stimson, Superintendent, has been appointed Acting General Manager. E. H. Barnes, Resident Engineer, has been appointed Superintendent, and Anson Green has been appointed Resident Engineer.

*Logansport & Toledo.*—See Vandalia Line.

*Minneapolis, St. Paul & Sault Ste. Marie.*—W. L. Clement has been appointed Assistant Chief Engineer, with headquarters at Minneapolis, Minn.

*New York, New Haven & Hartford.*—B. R. Pollock, hitherto Assistant Superintendent at Taunton, Mass., has been apointed Superintendent of the Air Line-Northampton Division, with headquarters at New Haven, succeeding C. C. Elwell, who has been appointed Superintendent of the Shore Line Division, with headquarters at New London, Conn., succeeding J. V. A. Trumbull, resigned.

*Norfolk & Western.*—N. D. Maher, hitherto General Superintendent, has been appointed General Manager. Joseph W. Coxe, hitherto General Auditor, has been appointed Comptroller, succeeding M. C. Jameson, deceased.

*Northern Pacific.*—See Atchison, Topeka & Santa Fe Coast Lines.

*Oregon Short Line.*—W. H. Bancroft, Vice-President and General Manager at Salt Lake City, Utah, has resigned (See Union Pacific.)

*Pennsylvania Company.*—I. W. Geer, Engineer of Maintenance of Way (Southwest System) at Pittsburg, Pa., has resigned. (See Vandalia Line.)

*St. Louis, Iron Mountain & Southern.*—George Dickson, Master Mechanic at Argenta, Baring Cross, Ark., has resigned.

*San Pedro, Los Angeles & Salt Lake.*—N. H. Foster, hitherto Assistant to the General Manager of the Southern Pacific, has been appointed Purchasing Agent of the S. P., L. A. & S. L., with headquarters at Los Angeles, Cal.

*Southern Pacific.*—Richard Stevenson has been appointed Manager of Purchases and Supplies, succeeding R. P. Schwerin, resigned to assume other duties with the Pacific Mail Steamship Co.

N. H. Foster, Assistant to the Manager, with headquarters at San Francisco, Cal., has resigned. (See San Pedro, Los Angeles & Salt Lake.)

*Tennessee Railroad Commission.*—J. N. McKenzie has been elected Chairman, succeeding N. W. Baptist, resigned.

*Terre Haute & Logansport.*—See Vandalia Line.

*Toledo, Peoria & Western.*—G. W. Winters, for many years agent, and for the past ten years City Passenger Agent at Peoria, has been appointed Assistant General Passenger Agent.

*Union Pacific.*—W. H. Bancroft, hitherto Vice-President and General Manager of the Oregon Short Line, has been appointed General Manager of the U. P., with headquarters at Omaha, Neb. F. W. Pfleging has been appointed Supervisor of Signals.

*Vandalia Line.*—I. W. Geer, hitherto Engineer of Maintenance of Way of the Pennsylvania Company (Southwest System), has been appointed Superintendent of the Terre Haute & Logansport and the Logansport & Toledo, with headquarters at Logansport, Ind.

*Wiscasset, Waterville & Farmington.*—S. J. Sewall has been appointed Superintendent, with headquarters at Wiscasset, Me.

## CAR BUILDING.

*The Erie* has ordered 200 refrigerator cars from the American Car & Foundry Co.

*The Delaware & Hudson* is reported in the market for 1,500 freight and three cafe cars.

*The Union Tank Line Co.* denies that it is in the market at present for 300 tank cars.

*The Hardwick & Woodbury*, Hardwick, Vt., is reported in the market for 25 flat cars.

*The Grand Rapids & Indiana* is in the market for six passenger coaches and one cafe car.

*The Atchison, Topeka & Santa Fe* has ordered 10 additional refrigerator cars from the American Car & Foundry Co. These are to be the same as the refrigerator cars which the American Car & Foundry Co. is now building for them.

*The Toledo, Peoria & Western* has ordered two passenger coaches from the Pullman Co., for February delivery. The cars will be 68 ft. long, over platforms; 10 ft. ¼ in. wide, and 14 ft. 8 in. high, over all. The special equipment includes National-Hollow brake-beams, Congdon cast iron brake shoes, Westinghouse air-brakes, Janney couplers, Forsyth roller tip curtain fixtures, Pantasote curtain material, Excelsior door fastenings, Gold heating system, Pressed Steel journal box lids, Standard steel platforms, six-wheel trucks, and 33 in. cast iron wheels.

*F. M. Hicks, of the Hicks Locomotive & Car Works* has sold the following equipment: C. E. Beyerle, one theatrical car; Vancouver, Westminster & Yukon R. R., two passenger coaches; C. H. Sharp, five box cars; Kane & Elk R. R., eight flat cars; W. N. Sharp, five flat cars; Valley R. R., 10 box cars and 20 flat cars; St. Louis, El Reno & Western R. R., 12 box cars, 20 flat cars and 1 caboose; Himmelberger, Harrison Lumber Co., four flat cars; Wichita Valley R. R., six box cars; Carolina & Western R. R., 10 flat cars, and the United Zinc & Chemical Co., Kansas City, Mo., seven tank cars.

*The Long Island*, as reported in our issue of January 1, has ordered 200 box cars of 60,000 lbs. capacity from the South Baltimore Steel Car & Foundry Co. These cars will weigh 33,200 lbs., and will be 34 ft. 10¼ in. long over end sills, 8 ft. 8¼ in. wide over side sills, and 12 ft. 5¼ in. high, with wooden frames and underframes. Special equipment includes: Steel axles, Sterlingworth brake beams, Westinghouse-American brakes, Ajax brasses, Tower steel couplers, National door fasteners, Dunham doors, Soule dust guards, Symington journal boxes, Sessions-Standard draft rigging, Torsion-proof roofs, Fox pressed steel trucks, and cast iron wheels.

## BRIDGE BUILDING.

ACKLEY, PA.—A contract has been let to the Groton Bridge Company for building a new bridge over the Conewango Creek, to cost about $12,000, for the joint account of the town and the Warren-Jamestown Electric R. R.

AKRON, OHIO.—The Akron & Barberton Belt R. R. may build steel bridges at Martha avenue and at Brown street early this spring.

BOSTON, MASS.—Bids are wanted Jan. 25, by the Metropolitan Park Commission, for building a bridge over the Boston & Maine tracks, Western Division, Revere Beach Parkway, Medford.

CADILLAC, MICH.—Bids are wanted Feb. 1, by the Board of Public Works, for building a bridge over Clam River on Haynes street. W. J. Smith is clerk.

CINCINNATI, OHIO.—Bids are wanted Feb. 6, by the Board of County Commissioners, for the substructure and approaches of a bridge over Jordan Creek in Miami Township.

COHOES, N. Y.—The United Traction Company and the city may jointly build a new bridge over the Mohawk River between Cohoes and the Island District, at a cost of about $18,000, to replace the present structure.

COLUMBUS, OHIO.—The Urbana, Mechanicsburg & Columbus has plans ready for the building of several bridges on a new extension of its road, the longest of which is to be 500 ft.

CONCORDIA, KAN.—Bids are wanted Jan. 26 by the Board of County Commissioners, for building a steel bridge and approaches over the Republican River. E. J. Alexander is county clerk.

DAYTON, OHIO.—The Pennsylvania has asked permission of the city authorities to build a new bridge over the Cooper Hydraulic at Bainbridge street.

DUNVILLE, ONT.—Bids are wanted Jan. 23, by R. F. Miller, County Clerk, for building the steel superstructure of two 60-ft. spans and two stone abutments, for a bridge over Oswego Creek.

ELIZABETHTOWN, OHIO.—Bids are wanted Feb. 6, by the Board of County Commissioners of Hamilton County at Cincinnati, for building the substructure and superstructure of the bridge over the Great Miami River. Eugene L. Lewis is County Auditor. (Dec. 18, 1903, p. 911.)

EMMETSBURG, IOWA.—Bids are wanted Feb. 1, by T. R. Martin, County Auditor, for furnishing the material and building all the bridges that may be needed in Palo Alto County during the year 1904.

FULTON, MO.—Bids are wanted Feb. 2, by H. C. D. Halley, County Bridge Commissioner, for building a 200-ft. steel wagon bridge, 16 ft. wide, on iron tubes, over Auxvasse Creek on Steedman road.

GRAYS POINT, MO.—The Senate bill extending the time for completing the bridge across the Mississippi River at Grays Point, Mo., was passed by the Senate on January 5 and by the House of Representatives on January 11. (Jan. 8, p. 33.)

HARRISBURG, PA.—The Board of Public Buildings and Grounds has awarded a contract for the Stroudsburg bridge over Broadhead Creek to the York Bridge Company, at $44,974.

JEFFERSONVILLE, IND.—Bids are wanted Feb. 1, by the Board of Commissioners, for building a bridge at the Black Diamond mill; also for transferring two of the spans of the old bridge to Annadale's Ford, and Townsend's crossing; also for building the abutments at these places.

KANKAKEE, ILL.—The Board of Public Works is having plans made for a concrete steel arch bridge 600 ft. long, over the Kankakee River, for which the contract will be let next month.

LOCK HAVEN, PA.—The Grand Jury has recommended the building of a new bridge over Fishing Creek in Green Township.

LOUISVILLE, KY.—The Louisville & Southern Indiana Traction Company may build a double track steel viaduct from Franklin street to Wenzel street, if its application for a franchise is granted.

MARKED TREE, ARK.—The bill authorizing Poinsett County, Ark., to build a bridge over the St. Francis River, at Marked Tree, Ark., was passed by both the U. S. Senate and House of Representatives last week. (Jan 8, p. 33.)

MINNEAPOLIS, MINN.—Bids are wanted Jan. 28 for $415,000 of city bonds, the proceeds of which to the extent of $165,000 will be used for bridge repair work. Joshua Rogers is City Comptroller.

MISHAWAKA, IND.—The question of building a new bridge is under consideration; it is to replace the present structure over the St. Joseph River on South Race. J. M. Brown is County Auditor.

MONTGOMERY, ALA.—The U. S. Senate, on January 12, passed the bill extending for three years the time for completing the bridge to be built by the Montgomery Bridge Co. across the Alabama River, at Montgomery, Ala.

NATCHITOCHES, LA.—The Police Jury has appointed a committee to ask bids for building two steel bridges, one over the Old River at Cypress street, and the other over Cane street at Derry Station; also to re-advertise for bids for rebuilding the iron railroad bridge over Red River at Grand Ecore.

NEOSHO, MO.—Bids are wanted Feb. 5, by R. F. Jones, Newton County Bridge Commissioner, for building two bridges—one over Shoal Creek and one over Capps Creek.

NOME, ALASKA.—A bill was introduced in the U. S. Senate on January 12, authorizing the City of Nome, Alaska, to build a free bridge across the Snake River.

OMAHA, NEB.—A bridge may be built over the Missouri River by the Central Railroad & Bridge Company.

PENNSYLVANIA.—A bill is before the Committee on Interstate and Foreign Commerce of the House of Representatives authorizing the Eastern R. R. Co. to build a bridge across the Monongahela River in Pennsylvania.

PHILADELPHIA, PA.—The Philadelphia & Reading, it is reported, has plans ready and will soon ask bids for building a double deck pier and a bridge over Delaware avenue at Noble street wharf.

RIVESVILLE, W. VA.—Bills were introduced in both Houses of Congress last week authorizing the Buckhannon & Northern R. R. Co. to build a bridge across the Monongahela River, near Rivesville, W. Va.

ST. LOUIS, MO.—Bids are wanted Jan. 26, by the Board of Public Improvements, for building a temporary bridge over the tracks of the Missouri Pacific and the St. Louis & San Francisco to cost about $40,000. Plans are being made for a permanent bridge of stone and steel.

SILEX, ARK.—Bids are wanted Feb. 23 by the Clerk of Pope County for building a bridge 190 ft. span, and approaches of 276 ft., with 14 ft. roadway.

VICKSBURG, MISS.—Bids are wanted Feb. 1, by J. D. Laughlin, Warren County Clerk, for building a bridge over the bayou at Adams street.

WASHINGTON, D. C.—A bill has been introduced in the United States Senate authorizing a bridge across Rock Creek, at Q street, N. W., Washington, D. C.

WINGHAM, ONT.—Bids are wanted Jan. 23 for building four county bridges. John Ansley is County Commissioner.

### Other Structures.

ANDERSON, IND.—Bids are wanted Jan. 28, by the Board of Water Works trustees, for one filter building complete, and a steel truss; also for 2,800 cu. yds. of concrete masonry. H. H. Rogers is City Engineer.

BLOOMINGTON, IND.—The Indiana State University, it is stated, will build a power plant 50 ft. x 100 ft. to cost about $20,000.

CANAL FULTON, OHIO.—The Fulton Pit Car Company it is reported, will increase its capital to $50,000, and build shops, in which industrial steel cars will be made.

CHICAGO, ILL.—The Illinois Central, it is reported, will build a new station at its Randolph street terminal.

CINCINNATI, OHIO.—The Cal Hirsch Iron & Rail Company of St. Louis, it is reported, has bought 10 acres of ground in Elmwood Place on which it will build a large foundry.

EAST CAMDEN, N. J.—The American Dredging Company is preparing to fill about 40 acres of land and build wharves and piers on the Delaware River as a site for shops.

HAWKINSVILLE, GA.—The Hawkinsville & Florida Southern, it is reported, will build shops at Hawkinsville, to take the place of those which were recently destroyed by fire at Pitts.

KALAMAZOO, MICH.—The Michigan Traction Company, it is reported, will build a new car house in Kalamazoo.

MADISON, WIS.—The Madison Traction Company, it is reported, is preparing plans to build a car house 200 ft. x 200 ft., contract for which will be let in March.

MINNEAPOLIS, MINN.—Ellis Woolman, maker of railroad equipment, has recently completed a shop for rebuilding locomotives, and may put up a shop for rebuilding passenger cars and an addition to the machine shop; some new machinery for shop equipment is to be bought.

NELSONVILLE, OHIO.—The Nelsonville Foundry & Machine Co. has under consideration the question of adding a large building in which to make mine cars.

NEWPORT, R. I.—The New York, New Haven & Hartford, reports say, may build a new station.

ONEIDA, N. Y.—Large additions, it is said, will be made to the works of the Schubert Bros. Gear Co.

OWOSSO, MICH.—The Grand Trunk, it is reported, will build a new freight station at a cost of about $30,000 at this place.

PITTSBURG, PA.—The Standard Material Power Company, of Canal Dover, Ohio, formed for the purpose of building large locomotive works at that place, and which had completed four buildings, will, it is reported, abandon this plant and put up buildings at Pittsburg. A. L. Schultz, of the Pittsburg Engineering Company, is arranging the financing of the locomotive company.

SACRAMENTO, CAL.—The Southern Pacific, it is reported, will build additions to its shops to include a new roundhouse to hold 30 locomotives; an extension to the car repair shops, enlargement of the copper shop, and a new tank repair shop 120 ft. x 400 ft., at a total cost of about $100,000.

SANTA BARBARA, CAL.—Bids are wanted Feb. 23, by the Commissioners of the Water Works Department, for a tunnel 19,560 ft. long.

SPRINGFIELD, OHIO.—The Springfield, Troy & Piqua Railway Co., it is reported, will build a car house and repair shop, also a freight house at Springfield.

SYRACUSE, N. Y.—Kane & Roach, makers of special rolling mill and other machinery, are preparing plans to rebuild their works at once. They are also in the market for some machinery.

TAMPA, FLA.—The Tampa Electric Company, reports say, will spend about $100,000 for building and equipping a new power house at Tampa.

WASHINGTON, D. C.—Bids are wanted Jan. 30, by the Navy Department, for building a concrete and granite dry dock at the Brooklyn Navy Yard, 590 ft. long and 90 ft. wide, at the entrance; inside coping and body of dock 132 ft., with a floor width of 90 ft.

## RAILROAD CONSTRUCTION.

### New Incorporations, Surveys, Etc.

ALBUQUERQUE EASTERN.—Press reports state that contracts for grading this line from Moriarty, N. Mex., to Albuquerque, 46 miles, will soon be let. Grading was begun last summer, but after a few miles had been completed, the work was stopped. It is reported that this road is being built in the interest of the Santa Fe Central. The headquarters are at Albuquerque, N. Mex. (Dec. 18, 1903, p. 912.)

BINGHAMTON & WILLIAMSPORT.—A charter is being asked by this company from the New York State Railroad Commission to build a railroad from Binghamton, N. Y., to the Pennsylvania State line.

CAPE BRETON.—This road was extended during the past year from Grand Anse to St. Peters, 11 miles. It is proposed to extend the line from St. Peters to Louisburg and Sydney, 62 miles. The road runs at present from Point Tupper to St. Peters, 30 miles. G. E. Johnson, St. Peters, is General Manager.

CAROLINA & TENNESSEE SOUTHERN (SOUTHERN).—Grading is reported in progress on this road from the Tennessee State line to Bushnell, N. C., 26 miles. W. J. Oliver, Knoxville, Tenn., is the contractor. The road is being built in the interest of the Southern. (See Construction Supplement.)

CHICAGO, ANAMOSA & NORTHWESTERN.—Articles of incorporation have been filed by this company in Iowa. It is proposed to build a railroad from Anamosa, Iowa, in a northwesterly direction to a point in Delaware County. The authorized capital of the company is $100,000. Peter Kiene, D. I. Glasser, W. T. Sham and others, of Dubuque, Iowa, are incorporators.

CHICAGO, INDIANA & EASTERN.—It has been officially announced that as soon as the weather permits, work will be begun on the extension of this road from Muncie, Ind., southeast to Hagerstown, 25 miles. Connection will be made for Cincinnati by way of the Pennsylvania lines. H. E. Grew is President.

CLEVELAND, CINCINNATI, CHICAGO & ST. LOUIS.—It is reported that this company will begin surveys at once for a cut-off between Green Castle, Ind., and a point eight miles west. The cut-off will save one mile and will cut out several curves along Big Walnut Creek.

DENVER & KANSAS NORTHERN.—Articles of incorporation have been filed by this company in Kansas. The company has its headquarters in Beloit, and proposes to build six lines in Northwestern Kansas, the estimated aggregate length of which will be 1,400 miles. The directors of the company are: J. P. Pomeroy, Colorado Springs; E. J. Williams, Stockton; A. T. Rodgers, Beloit; W. W. Caldwell, Concordia; F. T. Burnham, Beloit; J. S. Parks, Topeka; J. R. Mulvane, Topeka, and others.

DURHAM & SOUTHERN.—A charter has been granted this company to build a railroad from Durham, N. C., south to Apex, 25 miles. Connection will be made with the Cape Fear & Northern at Apex. B. N. Duke is said to be interested.

HARRISBURG & SOUTHERN.—Contract for grading this road from Harrisburg, Ill., to Marion, has been let to Bloodgood & Lamb, Harrisburg. A mortgage has been made with the Hartford Life Insurance Company at Hartford, Conn., to secure an issue of bonds to pay for building the road between these points. A. R. Langley, Harrisburg, Ill., is Chief Engineer.

KANAWHA, GLEN JEAN & EASTERN.—Press reports state that this company proposes to build an extension from Thurmond, W. Va., to Kilsyth, 11 miles. It is stated that contracts for grading will be let early in the spring. Thomas Nichol, Kilsyth, is Chief Engineer.

KANSAS, ELK CITY & TEXAS.—A charter has been granted this company in Oklahoma to build a railroad from a point on the Oklahoma-Kansas State line, near Kiowa, Kan., southwest through Oklahoma by way of Elk City to Eagle Pass, Texas, 300 miles. The stockholders are all from Elk City, Okla. T.

KNOXVILLE, LA FOLLETTE & JELLICO.—Contract has been let to the Callahan Construction Company, of Knoxville, Tenn., for building the K., LaF. & J. tunnel at Clear Fork. The tunnel is situated in such a manner that work can be rapidly pushed through. Construction will be begun at once.

MASON & OCEANA.—An officer writes that this company has completed during the year 11 miles of line from Walkersville, Mich., to Maple Range. The road is now in operation from Buttersville to Maple Range, 40 miles. Work is in progress on an extension from the present terminus to Hesperia, four miles. M. F. Butters, Buttersville, Mich., is President. (See Construction Supplement.)

MIDLAND VALLEY.—This company recently completed its line from Hartford, Ark., west to Bokoshe, Ind. T., a distance of 35 miles. It is now reported that an extension will be built from Bokoshe northwest to Briartown, 25 miles, and it is stated that the contract for grading this line has been let to Kohman & McMurray. F. A. Molitor, Fort Smith, Ark., is Chief Engineer. (Jan. 1, p. 18.)

MISSISSIPPI VALLEY.—A charter has been granted this company in Missouri. It is proposed to build from Tyler west to the boundary line between Pemiscot and Dunklin Counties, with a branch line from Tyler southwest to Blytheville, Ark. The total length of the lines will be 18 miles. The incorporators are H. A. Tyler, R. A. Tyler, both of Hickman, Ky.; J. A. Wheeler and E. Saunders, of Tyler, and C. B. Farris, of Caruthersville, Mo.

MEXICAN ROADS.—A concession has been granted in the State of Michoacan to the United States Packing Co. for building a railroad from Uruapan, the terminus of the Morelia branch of the National R. R. of Mexico to Los Reyes, 80 kilometers. The headquarters of the company are at Morelia. J. W. De Kay is interested.

NEW ORLEANS, NATALBANY & NATCHEZ.—This company has completed its line for a distance of 16 miles from Natalbany, Miss., to Montpelier, La. N. R. Smith, Natalbany, is interested.

NOVA SCOTIA EASTERN.—Press reports state that financial arrangements have been made for building 250 miles of the Nova Scotia Eastern and that work will begin early in the spring. H. H. Fitzpatrick, of New Glasgow, N. S., is interested.

OAXACA & EJUTLA.—This road has been completed out of Oaxaca for a distance of 37 miles. The remaining portion of the line to Ejutla, seven miles, is now being graded, and it is stated that the entire line will be completed before the summer. M. Calderon, Mexico City, is Secretary.

OHIO RIVER & COLUMBUS.—An officer writes that this company has completed its line from Ripley, Ohio, to Georgetown, 13 miles. Grading is now in progress from Georgetown to Sardinia, 10 miles. An extension is projected from Ripley, Ohio, south to Maysville, Ky., 10 miles. W. G. Wagenhalls, Cincinnati, Ohio, is Chief Engineer. (June 5, 1903, p. 400.)

OREGON R. R. & NAVIGATION COMPANY.—This company will soon begin work on an extension of its line from Riparia, Wash., northwest along the Snake River to Lewiston, Idaho, 60 miles. Deeks & Deeks are reported to have the contract for grading. It is stated that the extension will be operated jointly by the Oregon R. R. & Navigation Company and the Northern Pacific.

PITTSBURG & ALLEGHENY TUNNEL.—This company has asked for a franchise to build a subway from Pittsburg, Pa., to Allegheny under Allegheny River, with two street car tracks, a 10-ft. roadway, and a 6-ft. walk.

RALEIGH & EASTERN NORTH CAROLINA.—Surveys have been practically completed for this proposed road from Raleigh, N. C., in an easterly direction through Wilson to Greenville and Washington. The line will eventually be extended to Pamlico Sound, 100 miles. About three-fourths of the right of way has been secured and it is stated that contracts for grading part of the line will be let within 30 days. J. M. Turner and E. B. Barbee, Raleigh, N. C., are interested. (Oct. 30, 1903, p. 786.)

SAN DIEGO BAY TERMINAL.—Articles of incorporation have been filed by this company in California. It is proposed to build about five miles of railroad in and about San Diego. G. W. Marston, U. S. Grant, J. E. Boal and others, of San Diego, are interested.

SAN FRANCISCO & NAPA.—Surveys are reported completed and rights of way secured for this proposed line from San Francisco, Cal., to Napa, 50 miles. S. M. Van Wyck, Jr., of San Francisco, is President, and H. P. Goodman, of Napa, is Vice-President. (Dec. 11, 1903, p. 896.)

SAN FRANCISCO & NORTHWESTERN.—An officer writes that there have been five surveying parties in the field since August 1, 1903, for the purpose of locating the route from Eureka to San Francisco. Surveys have been made from Eureka to 15 miles south of Willits in Mendocino county and also as far south as Healdsburg in Sonoma county on the California Northwestern, 66 miles north of San Francisco. The final surveys will not be made until the location surveys are completed, which will not be for some time yet. W. B. Storey is the Engineer in charge of the work. (Oct. 16, 1903, p. 750.)

SEABOARD AIR LINE.—Contract has been let to L. H. Vaughan, of Roanoke, Va., to build 12 miles of new road between Birmingham, Ala., and Atlanta, Ga. The work is at the Birmingham end of the road, with two tunnels, one 800, the other 1,200 ft. long, and will cost about $500,000.

SOUTHERN INDIANA.—Press reports state that this company will soon begin work on its proposed lines from Terre Haute, Ind., north to Chicago, 150 miles, and from Elnora, Ind., to Evansville, 80 miles. It is stated that grading will be begun on both lines at the same time, and that the work will be completed in about two years. The company will double track its present line from Terre Haute to Black Hawk, 16 miles, during the coming year. (Oct. 30, 1903, p. 786.)

SOUTHERN PACIFIC.—It is reported that the Southern Pacific and the Rock Island will build a causeway with concrete retaining walls, from the city of Galveston to the mainland across the bay.

TABOR & NORTHERN.—Press reports state that this company will build an extension from Malvern, Iowa, east to Hastings, five miles, paralleling the Chicago, Burlington & Quincy between these points. The road runs at present between Tabor and Malvern, nine miles. Robert McClellan, Tabor, Iowa, is President and General Manager.

TENNESSEE ROADS.—It is reported that a railroad will shortly be built from Lone Mountain, Tenn., northeast to St. Paul, Va. Location surveys are now in progress. L. M. Jarvis, Sneedville, Tenn., is said to be interested.

TEXAS, NEW MEXICO & WESTERN.—It is reported that this company will let contracts within 20 days for building its line from Decatur, Texas, west to Roswell, N. Mex., 300 miles. E. P. Spears, Dallas, Texas, is President. (Jan. 8, p. 34.)

TEXAS, SABINE VALLEY & NORTHWESTERN.—It is reported that this road is to be extended from Long View, Texas, north 16 miles to a connection with the Texas Southern at Gilmer. The line will eventually be extended from Gilmer to Pittsburg, Texas. The distance between Long View and Pittsburg is 38 miles. G. M. D. Grigsby, Long View, is President.

TRINITY & BRAZOS VALLEY.—This company has filed an application with the Texas State Railroad Commission for authority to issue bonds to the amount of $50,000 a mile on 30 miles of road. The company has just completed its line from Mexia, Texas, to Cleburne, 70 miles. R. H. Baker, Austin, is General Manager. (Jan. 15, p. 54.)

WINONA, WARSAW & GOSHEN.—This company has been incorporated in Indiana. It is proposed to build from Goshen south to Warsaw, 30 miles. J. B. Hanna, S. G. Morris, B. G. Collins and others are incorporators.

## GENERAL RAILROAD NEWS.

CHICAGO, ROCK ISLAND & PACIFIC.—This company has announced that it will ask authority from its stockholders at their next meeting on March 21 to issue bonds to the extent of $163,000,000. *The Commercial and Financial Chronicle* says: "It is deemed advisable to limit the amount of the new issue to a sum which will make the new bonds available for investment under the New York savings bank laws. The bonds are to bear interest at not exceeding 4 per cent. per annum and will mature on April 1, 1934, but are subject to call at the company's option prior to April 1, 1911. The amount of bonds 'issuable forthwith' is $15,000,000, but the company, being in no haste to obtain funds, will market these only as conditions are favorable. The remainder of the bonds is reserved for refunding and for new acquisitions, additions, improvements, etc. The new mortgage, it is stated, will be made a first lien on terminal property at St. Paul, Minneapolis and St. Louis; new equipment and new shops at Moline, costing in all $18,564,000; and on railroad lines aggregating 626 miles and on first mortgage bonds on 518 miles of road. It will also be a junior lien, subject to existing mortgages, on all the railways of the Rock Island system, aggregating, exclusive of leased lines and trackage, 5,689 miles. The plan will be presented for the approval of stockholders at the meeting on March 21, 1904. It is generally understood that Speyer & Co. will handle the financial end of the plan."

ERIE.—At a meeting of the Board of Directors of this company on January 19 a dividend of 2 per cent., payable to stockholders of record Jan. 30 out of the surplus net earnings of the company for the six months ending December 31, 1903, was declared upon the first preferred stock. While nothing official has been given out regarding the termination of the voting trust, it is stated that as 4 per cent. will have been paid in one year on February 29, the voting trust will end on that date. This voting trust consists of Louis Fitzgerald, J. P. Morgan and Charles Tennant, and was created to hold the stock of the Erie for five years, and thereafter until the first preferred stock has received 4 per cent. cash dividends in one year.

FORT WAYNE & SOUTHWESTERN.—This company has filed a notice with the Secretary of the State of Indiana of an increase of $1,875,000 in its capital stock. The proceeds from the sale will be used to pay for building the road from Indianapolis to Ft. Wayne. The increase was voted at a recent meeting of the stockholders. The total capitalization is at present $2,000,000.

MAINE CENTRAL.—At a recent meeting of the stockholders of this company it was voted to acquire the capital stock of the Washington County Railroad. This latter road runs from Washington Junction, Me., to Eastport. 102 miles, and was sold at auction on Dec. 17, 1903. (Dec. 25, p. 930.)

MISSOURI, KANSAS & OKLAHOMA.—This company has filed a mortgage for $5,000,000 with the Central Trust Co. of New York, covering the line of the M. K. & T. now building in Oklahoma and Indian Territories.

SOUTHERN PACIFIC.—In addition to the supplemental mortgage recently made by this company bringing under the lien of its 2-5-year 4½ per cent. gold bonds of 1900 various stocks and bonds and four ocean steamships, a second mortgage has been recorded. This is in the nature of a car trust mortgage and is a lien upon equipment not included under any bonded indebtedness. Against this equipment the company is authorized to issue $5,775,000 of the 2-5-year 4½ per cent. bonds, making the total amount of said bonds issued or issuable at any time $28,090,000, the total authorized issue being limited absolutely to $30,000,000.

WASHINGTON COUNTY.—See Maine Central above.